SCIENCE

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*THE GEOLOGY OF GOVERNMENT EXPLORATIONS.**

I HAVE chosen for the subject of my address this evening the development of our knowledge of the geology of the great West through the agency of explorations and surveys conducted under government auspices.

To the older of our members, especially to those who took part in those early explorations, the matter may appear somewhat trite, but to the younger ones, whose geological memory does not go back beyond the present Survey, I have thought that it might be interesting to listen to a brief account of the origin and methods of work of these earlier organizations by one who was first connected with them very nearly thirty years ago.

The period to be considered commences about with the opening of the century, and is most naturally subdivided by the Civil War. But in this field, as in others, the accumulation of knowledge progresses with ever increasing rapidity, so that, while for the first and much longer sub-period it is possible to trace approximately the actual gains that were made in geological knowledge, in the second period it is only practicable to attempt to characterize and contrast the methods by which geological in-

* Address of the Retiring President of the Geological Society of Washington, delivered Wednesday, December 16, 1896.

vestigation was carried on. The first may be called the period of geographical exploration; the second that of geological exploration.

GEOGRAPHICAL EXPLORATIONS.

It was Jefferson's purchase of the Louisiana territory, in 1803, that gave to the United States government the first title to the Rocky Mountain region, but even prior to that time it appears that he had formed a project for its exploration. He tells us that in 1786, during his residence at Paris (as U. S. Minister) he met John Ledyard, of Connecticut, a companion of Captain Cook on his last voyage to the Pacific Ocean, who had just failed in the attempt to organize a mercantile company to engage in the fur trade on the western coast of America. Jefferson proposed to him 'to go by land to Kamchatka, cross in some of the Russian vessels to Nootka Sound, fall down into the latitude of the Missouri, and penetrate to and through that to the United States.' Ledyard eagerly embraced the idea, and after the permission to pass through her territory had been secured through Jefferson's influence, from the Empress of Russia, with an assurance of protection on his journey, he set forth from Paris and, proceeding via. St. Petersburg, had progressed to within 200 miles of Kamchatka, where he was obliged to go into winter quarters. When he was preparing to resume his journey in the spring he was arrested by an officer of the Empress (who by this time had changed her mind), put into a close carriage and conveyed, day and night without stopping, to the frontier of Poland. He returned to Paris much broken down in bodily health, and not long after (November 15, 1788) died at Cairo, Egypt, whither he had gone for the purpose of exploring the interior of Africa. Thus failed the first attempt at exploration.

1792. In 1792 Jefferson proposed to the American Philosophical Society at Philadelphia 'to set on foot a subscription to engage some competent person to explore that region in the opposite direction; that is by ascending the Missouri, crossing the Stony mountains, and descending the nearest river to the Pacific.' Capt. Meriwether Lewis, a connection by marriage of Gen. Washington, who was then stationed at Charlottesville, Va., on recruiting service, secured the appointment, and was to have had as sole companion the eminent French botanist, André Michaux, but when the latter had reached Kentucky he was recalled by the French Minister, then at Philadelphia, 'and thus failed the second attempt for exploring that region.'

1803. In 1803, two years after Jefferson had become President, in accordance with the suggestions contained in a confidential message from him, Congress so modified a pending act establishing trading houses with the Indian tribes as to extend its provisions to the Indians on the Missouri, and to authorize an exploration of the source of that river and of the best water communication from there to the Pacific, voting $2,500 for the expenses of the expedition.

Jefferson appointed to the command of this expedition Captain Meriwether Lewis, of whose special qualifications for this position he had had abundant proof during the preceding two years, during which he had served as his private secretary.

Lewis repaired at once to Philadelphia 'and placed himself under the tutorage of the distinguished professors of that place,' that he might be prepared to make the necessary scientific observations during his trip. At Lewis' suggestion Wm. Clark was associated with him in the direction, and for that purpose given a commission of captain in the army. Jefferson's detailed instructions of April, 1803, to guide his conduct after leaving the United States (the cession of Louisiana by France had not yet been

completed) afford a valuable insight into the conditions existing at that time, but time will not admit of any considerable quotation from them. He is to inform himself about the Rio Bravo, which flows into the Gulf of Mexico, and the Rio Colorado, which runs into the Gulf of California, which are 'understood to be the principal streams heading opposite to the Missouri and running southwardly.' Among the objects worthy of notice are mentioned: 'the remains and accounts of any animals which may be deemed rare or extinct; the mineral productions of every kind, but more particularly metals, limestone, pit-coal and saltpetre; salines and mineral waters, noting the temperature of the last and such circumstances as may indicate their character; volcanic appearances; climate,' etc.

Lewis left Washington on July 5, 1803, and did not reach there on his return until the middle of February, 1807. Meanwhile, after spending the winter of 1804–5 at the Mandan villages, in a bend of the Missouri about 40 miles above the present crossing of the N. P. R. R., at Bismarck, they had made a most successful trip across the mountains to the mouth of the Columbia river and back, an account of which is set forth in the admirable narrative first published in 1814 and recently republished with notes by Dr. Elliott Coues. This narrative shows a most intelligent observation of natural phenomena and makes mention of the existence of stone-coal along the upper Missouri river.

Schoolcraft's account of his visit in 1818 to St. Louis, then a city of 5,000 inhabitants, describes a museum established by Clark (then Governor of the Territory) containing a collection from his trip to the Rocky Mountains, including 'minerals, fossils, bones and other rare and interesting specimens,' and Nicollet in 1839 speaks of Cretaceous fossils brought in by Lewis and Clark from the upper Missouri river.

1805–7. Scarcely less remarkable were the explorations of Lieut. Zebulon M. Pike to the sources of the Mississippi in 1805, and in 1806–7 to the headwaters of the Arkansas, on the latter of which he made an unsuccessful attempt to climb the peak which has since born his name, and was finally taken from Santa Fé to Chihuahua as prisoner by the Mexican authorities.

Pike's expeditions were conducted under orders of Gen. Wilkinson, and were essentially military in their nature. A surgeon, Dr. Robinson accompanied them, but neither he nor Lieut. Pike have left any record of scientific observations in the narrative which was published in 1810.

1812. The war of 1812 now diverted the attention of government officials from Western explorations, but with the close of this war, when the treaty of Ghent had relieved the frontiers from the sanguinary Indian wars from which the people had been suffering, the prospect of a renewed emigration westward revived interest in exploration.

1820. J. C. Calhoun, Secretary of War under Monroe, a man of great intellectual grasp and energy of character, encouraged every means of acquiring a knowledge of the geography of the West. Two expeditions were organized under his orders in the year 1820, that of Maj. J. H. Long to the Rocky Mountains, and that of Gen. Lewis Cass along the south shore of Lake Superior to the sources of the Mississippi river.

To the former was attached Dr. Edwin James as botanist and geologist, who wrote the narative of the expedition, together with a report on the geological character of the country, which was published in 1823.

To Gen. Cass' expedition, an important part of whose object was to investigate the deposits of copper, lead and gypsum supposed to exist in the Northwest, a mineralogist was appointed in the person of H. R. Schoolcraft, a native of Albany Co., N. Y.,

who had distinguished himself by his investigations of the lead mines of Missouri.

GEOLOGY.

1820. Edwin James, who made the first geological report of a Western expedition, was a pupil of Amos Eaton. It was not until 1832 that Eaton adopted the system of identifying and correlating rock formations by means of their contained fossils. At the time of James' explorations geologists only attempted to distinguish rocks by their external lithological characters as belonging to one of the general great divisions of *primitive*, *transition*, *secondary* and *alluvions*, or recent deposits. Although James was evidently a shrewd observer, one would obtain but a confused idea of the structure of the country from his notes. Nevertheless he was one of the first, as Walcott remarks (Correlation Papers, Cambrian, p. 396) to attempt an extended correlation of geological formations of North America. He observed the general succession of rocks in the Appalachian, Ozark and Rocky Mountains, respectively, finding granites at the base in either case, and tracing the Carboniferous limestones through the two former.

He considered the red sandstones of the Appalachian and Lake Superior regions and of the Rocky Mountains to be of the same age and to probably correspond to the *old red sandstone* of Werner. He was the first white man to ascend Pike's Peak, and the ascent which was made from Manitou Springs, was by no means as easy as at the present day. He and his companion passed the night part way up the slope, where the ground was so steep that they had to prop themselves up by poles between two trees to keep from rolling down as they slept. James suggested the probable existence of artesian waters under the Great Plains, then called the Great American Desert. The material that Schoolcraft discovered in 1819 near Cape Girardeau, on the Mississippi River, and thought to represent the Chalk formation of Europe he found did not effervesce with acid, and classed it as a *native Argil*.

Schoolcraft, whose first government observations were made in the same year, devoted himself more particularly to the economic resources of the country. Already in 1818 he had spent three months in examining the lead mines in Missouri, and had extended his observations beyond the settlements into the Ozark Mountains. Determined to call the attention of the government to the value of its mines, he returned to New York via. New Orleans, and there published his book on the lead mines, which brought him to the attention of Mr. Calhoun, then Secretary of War, and resulted in his commission with the expedition of General Cass. His observations upon geology appear somewhat primitive and quaint, but are characterized by a shrewd common sense, as will be shown by a few quotations.

In speaking of the red sandstone on the south shore of Lake Superior near Grand Island, he says "the sandstone laps upon the granite and fits into its irregular indentations in a manner that shows it to have assumed that position subsequently to the upheaving of the country. Its horizontality is perfectly preserved even to the immediate point of contact. A mutual decomposition for a couple of inches into each rock has taken place. As to the geological age of the sandstone I possess no means of forming a decisive opinion. It consists of grains of quartz or sand united by a calcareous cement and colored by the red oxide of iron. In some places it imbeds pebbles of quartz of the size of a pigeon's egg, together with rounded masses of hornblende and other rocks, and it then resembles a pudding stone. It has no imbedded relics of the animal or vegetable kingdom so far

as observed, but this is not always conclusive of the age of the rock viewed at a given point, for it is known that these relics are never uniformly distributed throughout the substance of the rocks, even of the newest formations. Its position would indicate a near alliance to the old red sandstone. Werner has considered this rock in all situations as secondary. Bakewell places it in a class of transition rocks, in which he is followed by Maclure and Eaton. I am not prepared to decide upon the point * * *, and shall content myself in the present instance with a bare recital of the facts."

After the examination of the famous mass of native copper, variously estimated to weigh from one to five tons, which was the attraction of all travelers to the Lake Superior region, he says, in the course of his reflections upon its probable manner of occurrence, "there is reason to presume that the precious metals may be found in the northern regions of the American continent. Nothing appears more improbable than that the veins of silver ore that are so abundant in Mexico and the province of Texas are checked in their progress northward into Arkansas and Missouri by the effect of climate. This metal is known to be found in association only with certain limestones, schists and other rocks, and when these cease it is in vain to be sought. Other metals and minerals have their particular associations serving as a geognostic matrix, and hence rock strata may be considered as indexes to particular metals, minerals and ores, and the geologist is thus enabled to predict with considerable certainty from an examination of the exterior of the country whether it is metalliferous or not." In his 'Lead Mines of Missouri' he had mentioned the occurrence of chalk with flints, at Little Chain of Rocks, on the Mississippi River, which he says was worked commercially and found equal to foreign chalk. This was probably a bed of white pipe clay described by Shumard in 1871 (Missouri Geological Survey). He mentions the fluorspar of southern Illinois, the novaculite of the Arkansas Hot Springs, the red pipe stone of the upper Mississippi, coal in western Pennsylvania, Ohio, Virginia, Kentucky, Illinois and Missouri; also hydrogen gas or carburetted hydrogen at the Burning Spring on the Licking River. Pumice, he says, is brought down the Missouri River in the June floods, and probably comes from some volcanic mountain at the head of the river. A pseudo-pumice is also brought down which he supposes to have originated from the burning of beds of coal. He speaks of a mass of native iron, upwards of 3,000 pounds in weight, discovered on the banks of the Red River, and now (1819) in the collection of the New York Historical Society. "Its shape is irregular, inclining to oval form, its surface deeply indented and covered with oxide of iron. It is said to contain nickel, etc,"

1821. In 1821 Schoolcraft made another expedition with General Cass from Toledo across Ohio and Indiana, past the fluorspar deposits of southern Illinois, to St. Louis, returning by way of Chicago, an account of which was published as 'Travels in the Central Portions of the Mississippi Valley.'

1823. In 1823 a second expedition under Major Long was sent out by the War Department, which followed the Mississippi and Red River of the North to Lake Winnipeg, returning along the northern shore of Lake Superior. To this expedition Prof. William H. Keating, of Philadelphia, was attached as geologist, and published a narrative in two volumes in 1823 (George B. Whittaker, London). Keating in his narrative of the expedition, which started at Philadelphia, notes the evidences of old copper mining at South Mountain, in Maryland; the fact that coal mining is being

carried on at Cumberland, and at various points between there and Wheeling. He also remarks upon the Blowing Springs, and said he had no opportunity of testing whether they sent out gas or only air. He frequently mentions fossils observed, *encrinites* and *productus*, but does not attempt to define geological horizons by them, but only to judge whether the limestones were primitive (without organic life), transition or secondary.

1832. In 1832 Mr. Schoolcraft, under a commission from the government, commanded an expedition to the country about the sources of the Mississippi River, which he discovered took its rise in Lake Itasca, a narrative of which was published in 1834, and again enlarged in 1855.

1832–6. The expeditions of Capt. Bonneville, U. S. A., made famous by Irving's two narratives, were not, strictly speaking, government expeditions, being conducted under the auspices of the American Fur Trading Company, while he was on leave of absence from the army. No geologist was attached to the expedition, but the geographical results were very important, as by them was first determined the enclosed nature of the great interior basin, which had hitherto been supposed to have an outlet to the Pacific Ocean through the mythical Rio Buenaventura.

1834–5. G. W. Featherstonaugh, of whose origin little seems to be known except that he was a foreign traveler, was employed by Lewis Cass as Secretary of War, during the years 1834–5, to make geological investigations in the Ozark Mountains and along the elevated plateau separating the Missouri River from the St. Peter, or Minnesota River, known as the Coteau des Prairies. The report upon the first of these regions was published in 1835, and that upon the second in 1836.

In Featherstonaugh's time, light was commencing to come to the minds of American geologists out of the obscurity of ideas concerning the existing division of rocks into primitive, transition and secondary. It was already practically recognized that different horizons could be correlated in different parts of the world more safely and accurately by fossils than by lithological characters. Featherstonaugh found Carboniferous fossils widespread throughout the United States, on which he makes the following comments: "Although these fossils are not identically the same as their equivalents in Europe, yet many of them are strictly so; and in all cases I would assert the generic resemblances to be stronger than the specific differences. On this continent, where the Carboniferous limestones extend uninterruptedly for more than 1,000 miles, we find an equal amount of generic resemblance and specific difference, and it is certain that the specific difference between the most powerful species of living animals here and those in trans-Atlantic countries seems to be much greater than that which prevails among fossils of the two hemispheres." With regard to what had been generally known as primitive or inorganic rocks, however, he is not willing to accept the Wernerian or Plutonic theory of origin. Their differences with each other, except statuary marble, he remarks, result only from a difference in proportions of certain mineral constituents, which gives rise to the opinion that they had a common origin and "that they have all at some period been either ejected from central beds by the expansive power generated there, or that they have been great intumescing masses which on cooling have resolved themselves into various stages of crystallization, and that their varying products have been brought by fusion or solution into distinct central localities."

In his report Featherstonaugh publishes a section 12 feet long, extending from the Atlantic Ocean to Texas, which presents a

remarkably truthful representation, for the times, of the broader features of Appalachian structure. He calls attention to the fact that the littoral line on the Atlantic face of the mountains is found near the falls of the rivers. In his second report he gives a columnar section showing the correspondence of American and European formations, with average thickness of the latter, in which the Upper Cretaceous, Wealden, Oolite, and possibly the New Red sandstones are said to be deficient in the United States. In this section the Cambrian forms the base of the organic division. He remarks upon the rapid progress which geology has made in Europe during the past thirty years, and the increased interest manifested in this country as the result of his first report, giving rise to a movement among the States to undertake geological surveys. He says: "A geological map of the whole United States, where all the formations are exhibited on a large scale, and the most important deposits of fuel, metals and useful minerals be accurately laid down, would be a monument both useful and honorable to the country at home and abroad, and I trust the day is not distant when Congress will direct such a map to be constructed upon a scale commensurate with the undertaking."

1838. In 1838 J. N. Nicollet, a Savoyard naturalist, who had spent the last five years studying, at his own expense, the physical geography of the Southern and Mississippi Valley States, was commissioned by Col. Abert, of the Topographical Engineers, to make a map of the hydrographic basin of the Mississippi River.

In his report Nicollet remarks on the universal distribution of drift material, even on the summit of the Coteau, which had hitherto been called alluvium, but for which he prefers the term *Erratic deposites*. His principle contribution was the recognition of the fact that in that region there were limestones lower than the Carboniferous represented by fossils. He thought to have the Devonion in the lower part of the Mountain limestone, and he obtained Trenton fossils from the limestone around the Falls of St. Anthony. He also discovered the Cretaceous above Council Bluffs, and recognized its importance 'as destined to occupy a conspicuous place in the history of American geology.' Fort Pierre Chouteau was the upper limit of his explorations on the Missouri River. He got authentic accounts of pseudo-volcanoes caused by the spontaneous combustion of bituminous material within the rocks higher up the river, which he thinks may account for some, at least, of the pumice-like material that floats down the Missouri River.

1839. An important epoch in the study of western geology is marked by the work conducted under David Dale Owen, from 1839 to 1854. Dr. Owen was the son of Robert Owen, the social reformer, and at the same time a well-to-do manufacturer, who had settled in New Harmony, Ind., to carry out practically some of his social theories. David had received a liberal education abroad, both in Switzerland and Scotland, and had spent a year in London studying geology, in companionship with Henry B. Rogers. He later took the degree of M. D. in the Ohio Medical College in 1836. Having been appointed State Geologist of Indiana, he made a preliminary reconnaissance in 1837–8. The then Governor, James Whitcomb, became later United States Land Commissioner, and appointed Owen to make a survey of the Dubuque and Mineral Point land districts in Wisconsin and Iowa, under authority from Congress, in order to enable him to reserve from sale those sections containing mineral wealth. This work had to be done promptly, and it was commenced in September, 1839, and completed in February, 1840. He had 139 sub-agents and assistants under him, examining each sec-

tion under his instruction and supervision. Dr. John Locke was his geological assistant in this work. The determination of fossils of geological horizons was yet very imperfect, and the main conclusion arrived at was that the lead-bearing limestones were probably older than the Carboniferous.

1841. In 1841 the Wilkes Exploring Expedition, which, since 1838, had been cruising along the coasts and among the islands of the Pacific ocean, reached the coast of Oregon. Near the mouth of the Columbia river the ship Peacock on which was Prof. James D. Dana, the geologist of the Expedition, was wrecked, entailing the loss of all the latter's personal effects as well as many of his collections.

His loss was in the end, however, a gain to geological science, for on his trip across the Cascade mountains, and to San Francisco through the mountains of Oregon, past Mt. Shasta and down the valley of the Sacramento, he gained a personal knowledge of the geological conditions of the West, which was invaluable to him in later years when he was called upon to discuss the observations of later observers in the preparation of his Manual of Geology.

In his report upon the geology of the Wilkes Expedition, Dana calls attention to the fact that the slates of the Umpqua and Shasta regions resemble gold-bearing rocks of other regions, but it does not appear that he found actual evidence of the occurrence of gold.

He did observe the occurrence of sandstone dikes intersecting sandstones and shales near Astoria, and drew some interesting conclusions as to changes of level of the Coast region, which were further evidenced by the fiords along the coast and terraces along the river valleys; the latter he reasoned could not be explained by the current hypothesis that they were deposited in barrier lakes. As regards the whole Rocky Mountain region he concludes that it was probably in a great measure submerged until Cretaceous or later time.

1842–5. The three famous expeditions of Fremont were conducted in the years 1842, 1843–4 and 1845 respectively. They covered a very large part of the Cordilleran region, but unfortunately no geologist was attached to the expedition. Fremont himself, however, was a scientifically educated man, and had served under Nicollet in his expedition up the Missouri. His scientific notes, and the fossils and rocks collected, were afterwards worked up by Prof. James Hall.

Among the specimens thus brought and described were detected Niobrara limestones, upturned against the granites near Pike's Peak; green clays from the Eocene of the Bridger Basin, thought to resemble Cretaceous green sand; coal from the Muddy on the western edge of that basin, with fossil ferns which Hall said were not Carboniferous; fresh water shells from the Tertiary formations there and at the head of the Uinta River, on the east slope of the Wasatch Mountains; various eruptive rocks from the Snake River Valley, Blue Mountains and the Cascade Range; and a series of specimens from a bluff 700 feet high, which consisted largely of volcanic ash with fresh water fossil infusoria, which were probably formed of the Tertiary beds of the John Day River.

1846. In the spring of 1846 Dr. Wislizenus, 'a German by birth, but an American by choice,' as he characterizes himself, and evidently a man of wide scientific culture, undertook an examination into the geography and natural history of northern Mexico and Upper California at his private expense. While on his way west the war between the United States and Mexico broke out, and he was detained a prisoner for six months in the state of Chihuahua. Finding it impracticable to continue his work unaided, upon the arrival of the

American troops, he accepted the position of surgeon in the United States army, and finally returned with Col. Doniphan's command. His narrative, with scientific appendices, was printed by order of Congress. In it he notes Cretaceous rocks on the Great Plains, Cretaceous limestones with *Inoceramus* near Las Vegas, and the sandstones near Santa Fé 'thrown back at an angle of 100 degrees by the uplift of the granite.' Silurian limestones were seen near El Paso, and both Silurian and Cretaceous limestones around Chihuahua, Mexico. He does not appear, however, to have met with any outcrop of coal-bearing rocks. He remarks on a decadence of mining in Mexico and gives interesting statistics on the ancient silver and copper mines in the State of Chihuahua. In his report he gives what is called a geological map of the regions traversed, in which the occurrence of rocks of the different descriptions are indicated by words.

1847. In 1847 under the auspices of the United States Land office, of which James Whitcomb had now become Commissioner, David Dale Owen commenced his final survey of the Northwest Territory comprising parts of Wisconsin, Iowa, Minnesota and Nebraska. Although this work only incidentally extended into the region west of the Mississippi valley, it forms an important epoch in the geological history of the West, for it was the first systematically organized geological survey conducted under government authority, and by finally establishing geological horizons it has formed the basis of all later geological work in this region.

Dr. Owen had a large corps of scientific assistants and through them left a strong impress upon geological work in the Mississippi Valley. Among them were Richard Owen and E. T. Cox, who worked later in Indiana, A. H. Worthen in Illinois, Chas. Whittlesey at Lake Superior and J. G. Norwood in Kentucky.

After five years of field and one of office work, the report was published in two quarto volumes, with a large colored geological map, and a memoir on vertebrates by Dr. Joseph Leidy.

1847–1850. In this connection a brief mention may be made of the survey of the Lake Superior region, generally known as the Foster and Whitney Survey, because, although not carried on in the region under consideration, it had indirectly considerable influence on Western surveys.

Congress in March, 1847, had passed a law governing the sale of mineral lands in the Lake Superior land district which provided that the Secretary of the Treasury should cause a geological survey to be made previous to the offering of the lands for sale.

Dr. Chas. T. Jackson was appointed in the spring of 1847 to execute the survey, but resigned after two seasons' work, and the completion of the work was confided to J. W. Foster and J. D. Whitney, whose final reports were submitted in 1850 and 1851. They were assisted in their geological work by S. W. Hill and Edward Desor, the later an eminent Swiss geologist who had come to this country with Agassiz; while James Hall reported on their fossils and made valuable geological contributions to their final report. Whitney was not again in government employ, but played an important part in the development of its mineral resources, by his volume on the Metallic Wealth of the United States published in 1854, in which the theoretical views on ore deposits were far in advance of any published in this country or Europe, and which for many years was the only scientific treatise on the metallic mineral wealth of the country. He subsequently (1859–60) served on the Geological Survey of Wisconsin, making a special study of its lead mines, and in 1860 organized the State Geological Survey of California.

1849. In 1849 Dr. John Evans, under the

instruction of his chief, D. D. Owen, ascended the White River to the Bad Lands of Nebraska, along the southeast base of the Black Hills, and made collections of fossil vertebrates in the White River Miocene, whose existence had first been brought to notice through specimens sent in by the parties connected with the American Fur Trading Company. He also collected Mollusca in the Cretaceous beds from Fort Pierre up to a point 300 miles below the mouth of the Yellowstone, and traced the great lignite coal formation from there nearly to the Yellowstone River. The collections made at this time by Dr. Evans, together with those collected under the auspices of the Smithsonian in 1850 by T. A. Culbertson, and by Gen. Stuart Van Vliet of the United States army, were described in the Smithson contributions by Dr. Leidy in 1852. In this famous memoir the since well known forms *Titanotherium* and *Oreodon* were first described, and the age of the beds in which they occurred given as Eocene Tertiary.

1849-50. In 1849-50, under the orders of Col. Abert, of the Topographical Engineers, Lieut. Howard Stansbury made a survey of Great Salt Lake, and explored its valley and the surrounding mountains. No geologist was attached to his party, but his notes and fossils were reported upon by Prof. James Hall.

Stansbury noted the widespread occurrence of coal beds and recognized their future industrial importance, but does not appear to have obtained any data to determine their age. He brought in fossils from the Carboniferous limestone in Kansas, in Wyoming near Fort Laramie, and around Salt Lake Basin.

1851–52. In the summer of 1852 Captain R. B. Marcy and Brevet Captain George B. McClellan, of the United States Engineers, made an exploration in the Red River country from Fort Smith, Ark., to Fort Belknap, on the Brazos River, Texas. Dr. G. G. Shumard was appointed surgeon and naturalist to the expedition, and made collections which were submitted to various specialists for examination and study. Their reports are contained as appendices in Captain Marcy's report, published by act of Congress.

Hitchcock, the elder, reported on the specimens collected, except the fossils which were submitted to the latter's brother, Dr. B. F. Shumard, for identification. Carboniferous and Cretaceous forms were definitely determined, but Hitchcock was somewhat in doubt, owing to the imperfection of his data, whether the coals of the Brazos River were correctly assigned to the Carboniferous, on account of the loose texture of the rocks, and the fact that lignites of Tertiary and Cretaceous age were known to exist further north. The doubt is a reasonable one, for these coal beds are at the present day the most western workable coals of Carboniferous age known on the continent. Hitchcock remarks on the evidence shown in the canyons of the Llano Estacado, of the power of erosion, and shows that it was not necessary to resort, as Marcy was inclined to do, to the shattering of the crust by some great dynamic force to account for them.

In 1853 were commenced the numerous expeditions under the War Department to explore a route for a transcontinental railroad from the Mississippi Valley to the Pacific Ocean. To most of these parties a geologist or naturalist was attached, and the results of their observations, together with those of other naturalists, are found in the thirteen quarto volumes of the Pacific Railroad reports. They include Marcou, Newberry, Evans, Blake, Antisell, Gibbs and Schiel.

1853–4. Two reports made by Dr. John Evans to Gov. Stevens upon the geology of the northern route were lost in transit from the field to Washington. Dr. Evans died

at Washington in 1861 while at work upon his final report upon this region, which has consequently never been published.

To the expedition which explored the middle route across Colorado and Utah in 1853, under Capt. Gunnison, who was killed by Indians in Sevier Lake Valley, and through Wyoming, Utah and Nevada to California, in 1854, under Lieut. Beckwith, Dr. James Schiel was attached as surgeon and geologist. His report and Beckwith's narration contain scattered notes on the geology of the route, but no connected description.

Jules Marcou, who had come to this country from Switzerland with Agassiz, was the first geologist to study Western rock formations, who had had a field training in Europe. While his personal familiarity with different geological horizons in Europe enhanced the value of his field determinations, it also exposed him to the danger of laying too much stress in correlation upon mere physical resemblance. The route of the Whipple expedition, to which he was attached as geologist in 1853–4, followed the Arkansas and Canadian rivers from the mouth of the former to the source of the latter, and thence through New Mexico to Albuquerque; it then followed in a general way the general route of the Atlantic and Pacific Railroad to Los Angeles. His preliminary report was published in 1855. He also prepared a diagramatic section of the country from the Mississippi Valley to the Pacific Ocean; likewise a preliminary report upon the route followed by Capt. John Pope further south in Texas, made up from the notes and specimens collected by the latter. His claims as a geological discoverer rest upon the recognition of Carboniferous in Arkansas, the Permian and Carboniferous in New Mexico and Arizona, the Trias in Indian Territory, northern Texas and New Mexico. He thought also to have found the Jurassic, Neocomian and Chalk at different localities from New Mexico eastward. The geologists who have examined this field in later years and in greater detail have, in the light of all the geological knowledge that has accumulated since, assigned somewhat different ages to the beds described under the latter heads. This does not, however, detract from the value of Marcou's contribution to American geology, when one takes into consideration the circumstances under which his work was done and the little that was known of the geology of the West at the time.

Marcou did not make the official report upon his geological studies. When he was upon the point of embarking for Europe with his notes and collections, in order that, in working them up, he might be able to make comparisons with material in the museums abroad, they were seized by order of Jefferson Davis, then Secretary of War, and he was obliged to embark without them. His material was later worked up and the final report on the 35th parallel made by W. P. Blake, as official geologist of the expedition.

Blake's own observations were made as geologist in the expedition, under Lieutenants R. S. Williamson and J. G. Parke, in the summer of 1853, to determine the practicability of various routes from San Francisco through southern California to the mouth of the Gila River. The region is not one from which definite geological data could be obtained, the rocks, with the exception of recent and Tertiary formations, being barren of fossils and classed as metamorphic and eruptive. Eocene strata were recognized near San Diego, and Blake made interesting observations on desert phenomena, such as sand-polishing, prevailing west winds, etc. In economic geology he described the auriferous gravels and hydraulic washings, and concluded that the age of the formation of gold was contem-

poraneous with the uplift of the Coast Ranges and with the diorite or greenstone intrusions. His report was submitted in 1857.

1854–5. Dr. Thomas Antisell was geologist to Lieutenant Parke's expedition from San Francisco to Los Angeles through the Coast Ranges in 1854, and from the Pimas villages in Arizona, along the 32d parallel to the Organ Mountains, in New Mexico, in 1855. He considers the age of the Coast Ranges as post-Miocene, and notes the occurrence of bituminous deposits in southern California. He was influenced in his views on mountain ranges by Elie de Beaumont's theory of mountain uplift along the great circles, and endeavored to trace his systems in the West. He thus drew attention to the parallelism of the ridges in the great mountain ranges; the northwest trend in the Coast Ranges, the Sierra Nevada and the Arizona ranges, and the north and south trends in eastern New Mexico. He published colored sketch maps of sections of country passed through and indicated Carboniferous, Devonian and later rocks, but it appears that the only fossils he brought in were of Tertiary forms, and that his opinions as to age were based on the statements of other geologists and on lithological correspondence, and can be considered only as more or less well founded surmises.

1855. Dr. Newberry, as geologist of Williamson and Abbott's expedition from San Francisco to the Columbia River in the summer of 1855, noted the occurrence of Carboniferous and Cretaceous rocks in northern California, as evidenced by fossils collected by Dr. Trask, and that the Oregon coals of Coos Bay, Bellingham Bay and Vancouver Bay, probably of Tertiary (Miocene) age, rest on Cretaceous rocks, thus resembling the coals of the upper Missouri. He noted the existence of ancient glaciers at various points along the mountains, but gave no hints of active ones. He regarded the Sierras as of earlier upheaval than the Coast Ranges.

The contributions to the geology of the West in the period from 1855 to the Civil War had best be noted, not in strict chronological order, but geographically, taking first the southern region, next the interior, and finally the geology of the Great Plains.

1855–6. On the expedition to fix the boundary between Mexico and the United States under the treaty of 1854, which was conducted by Maj. W. H. Emory, Dr. C. C. Parry was geologist and botanist, and Arthur Schott, assistant geological observer.

In Maj. Emory's quarto report, first volume, are geological sketches of the country by Parry and Schott, with description of fossils by Hall and Conrad, and a general discussion of the geology of the region by James Hall. The report also contains a colored geological map of the Mississippi Valley and country to the west, which is the earliest colored geological map of the country west of the Mississippi published by the government.

The fossils described are mostly Tertiary and Cretaceous, and come in great measure from Texas. Upper Carboniferous limestones were identified at various points, and the presence of Silurian is suggested by Hall from a single fossil whose locality is not given. Hall discusses Marcou's section in northern Texas and New Mexico, and comes to the conclusion that the existence of any Mesozoic rocks in this region below the No. 1 Cretaceous, as determined by himself and Meek and Hayden, is not confirmed. The geological map prepared by him and Lesley is mainly interesting now as representing the blanks in the then geological knowledge of the interior of the Rocky Mountains. On the Great Plains his No. 1 Cretaceous included all that is now known as Trias, Jurassic and Lower Cretaceous, and was succeeded to the north by Upper

Cretaceous and Tertiary. Along a great part of the front of the Rocky Mountains and around the Black Hills was a strip of Upper Carboniferous and Upper Silurian separating the Cretaceous from the metamorphic nucleus. Likewise, along the face of several New Mexican ranges, in spots around Salt Lake and in the neighborhood of San Francisco Mountain, the Upper Carboniferous was represented. With this exception all the Western mountain region was indicated as metamorphic or unknown, as far as the Pacific Ocean, except for large areas of igneous and Quarternary in northern California and Oregon.

1857. To the expedition of Lieutenant J. C. Ives, sent out in the autumn of 1857 to explore the Colorado River from its mouth up to the head of navigation, Dr. J. S. Newberry was attached as geologist. A quarto report of this expedition was published by the government in 1861.

In this report Dr. Newberry summarizes the work that had been previously done in California, and makes the uplift of the Coast Ranges post-Miocene and probably later than the Sierra Nevada. His observations on the region of the Canyon of the Colorado are those of a trained geologist, and show a grasp of the broad conditions of structure of the Rocky Mountains much in advance of any previous observers. His published section of the rocks of the Grand Canyon, though not based in every instance upon direct lithological evidence, has not been essentially modified or improved by later observers up to the time of Walcott's investiation under the present Survey. The Algonkian formations between the Silurian and Archean do not occur in the region examined by him.

His general views on the structure of the mountains are seen in the following quotation (Ives Report, p. 47) :

"This much we can fairly infer from the observations already made on the geological structure of the far West, namely, that the outlines of the western part of the North American continent were approximately marked out from the earliest Paleozic times; not simply by areas of shallower water in an almost boundless ocean, but by groups of islands and broad continental surfaces of of dry land."

This remark was in opposition to the then generally received theory that the area of the Rocky and California mountains was till the Tertiary period occupied by an open sea.

1859. As geologist of the Macomb exploring expedition to the junction of the Grand and Green Rivers, Dr. Newberry collected much additional data on the geology of the plateau country. His report on the geology of the country, accompanied by a beautifully shaded topographical map made by Baron F. W. von Eggloffstein, was delayed by the confusion attending the Civil War, and was not published until 1876. It contains the following important additions to the geological knowledge of the region:

First, the determination of the Triassic age of the red sandstone by plant remains found at the copper mines of Abiquiu, New Mexico (Marcou's determination had been based on lithological evidence alone); second, the tracing of Upper and Middle Cretaceous formations along the south flanks of the San Juan into the upper Colorado Basin, and making a section of 6,000 feet of rocks from the Carboniferous to Cretaceous, inclusive; third, the finding of Saurian remains in the Canyon Pintado in the beds below the No. 1 Cretaceous, which, doubtless, represent the Atlantosaurus beds, since made famous by Marsh. Finally, although he only skirted around the isolated laccolitic mountains of that region, he shows a remarkable prescience in his remark upon the Sierra Abajo, that it has the appearance of a trachytic core pushed up through and uplifting Cretaceous strata.

In 1859 Capt. J. H. Simpson, of the Topographical Engineers, was commissioned by Gen. Albert Sydney Johnson, then stationed at Camp Floyd, Utah, to explore a new wagon road from Salt Lake Valley to the base of the Sierra Nevada, near Carson, and also eastward as far as Fort Bridger, in Wyoming. Henry Engelmann, of St. Louis, was appointed geologist of this expedition.

He showed unusual industry in collecting fossils and minerals, but his observations are those of a mineralogist rather than those of a stratigraphic geologist. From the determination of his fossils by Meek, it appears that he obtained Devonian forms in central Nevada, and lower Carboniferous in the Oquirrh Mountains of Utah, near Camp Floyd, thus determining lower horizons than had hitherto been known to exist west of the Missouri River.

Fossil-bearing Jurassic limestones were observed on the La Bonté Creek, near Fort Laramie, and on the western slope of the Wasatch, and a collection of fresh water fossils was made at the locality on Bear river, which for so many years puzzled paleontologists and geologists.

The probable Cretaceous age of the coal beds of the Weber Valley, and the San-Pete fields to the south was determined. He notes the widespread occurrence of eruptive rocks, especially through Nevada, but his lithological determinations, such for instance as that of phonolite, have to be accepted with some reservation, though they show more careful and intelligent study of their mineralogical composition than have been given by earlier geologists.

As his report was not published until 1875 (16 years after the observations were made), the facts determined were not available for the guidance of later explorers in in that region.

1853–6. The geology of the Great Plains is inseparably connected with the names of Meek and Hayden. They were first sent to the Bad Lands of Missouri by Prof. James Hall, in 1853. Hayden spent the summers of the two following years traveling with parties of the American Fur Trading Company, thus exploring geologically the Missouri Basin. He wrote a brief sketch on the geology of this region for Lieutenant Warren's 'Report on Explorations in the Dacota Country.' In this he mentions the Tertiary basin of White River, in which the great discoveries of vertebrate remains were then being made, the Bad Lands of the Judith River, and the great lignite basin extending from the mouth of the Cannon Ball River to that of the Muscleshell River.

1857. In 1857 he accompanied Lieutenant Warren to the Black Hills of Dakota, and submitted a report in November, 1858. (Reprinted in 1875, in Lieutenant Warren's 'Preliminary report on explorations in Nebraska and Dakota.') In this he gives a complete column of geological formations, as known in Kansas and Nebraska Territories, from the Potsdam upwards. The Potsdam had been detected by lower Silurian forms in the Black Hills. This and the discovery of the marine Jura, well represented by fossil forms, with fresh water beds just above them, which he was doubtful whether to place with the Jura or Cretaceous, and the discovery of vertebrates near the mouth of Judith River, which Dr. Leidy thought might be Wealden, constitute the important discoveries outlined in this report. The assumed existence of Devonian beds is evidently based on a mere conjecture which has not been substantiated.

1858. The summer of 1858 was spent by Meek and Hayden in making collections of fossils in Kansas Territory, and in 1859–60 Dr. Hayden served as geologist to the expedition of Captain W. F. Raynolds to the headwaters of the Missouri and Yellowstone Rivers. His geological work was in-

terrupted by the war, in which he served as surgeon in the army, and his report was submitted in 1867, but not printed until 1869. With this was a geological coloring of Raynold's topographical map, which gives in a very generalized form the current ideas with regard to the geology of the country east of the mountains. It shows the anticlinal structure observed in the Black Hills extended to all the ranges facing the plains. In the interior, granites, igneous and metamorphic rocks are all grouped under one color, and no formation between Carboniferous and Potsdam is recognized. The age of the coal-bearing beds is given as Tertiary.

1867. I will mention here the contributions of John LeConte in 1867, though not strictly in chronological order, nor under government auspices, yet they were part of the general scheme of exploration of the country for the projected Pacific railroad. He was attached to the party of Gen. W. W. Wright, of the eastern division of the Union Pacific Railroad, which was exploring various routes from Fort Lyon, Kansas, to Fort Craig, New Mexico. He made a more careful study of the coal-bearing rocks than had yet been made, and maintained his belief in spite of the evidence of fossil plants as interpreted by Lesquereux, that they were Cretaceous rather than Tertiary, a belief founded mainly on Molluscan fossils of Cretaceous age found by him in association with the coal beds, but in part also on a reasoning that the development of plant life in this country had not been strictly contemporaneous with that of Europe. On this point he says: "The difference between the plants of our early Cretaceous and those of the Middle Tertiary could be ascertained only by the aid of the stratigraphy of the region, and we have no right from a few resemblances in vegetables to infer the synchronism either of the Western lignite beds with each other, or any of them with the European Eocene and Miocene, except when supported by lithological evidence from animal remains.

"It would therefore appear plausible, in the absence of more direct evidence, to believe that since the introduction of dicotyledons in large numbers in our early Cretaceous there has not been any great change in the types of structure; and that such changes, while following in general plan those introduced on the eastern continent during this period, have not been synchronous with them."

He noted several unconformities in the beds, and presented a history of the orographic growth of the Great Plains in Mesozoic time, which shows a remarkably philosophical interpretation of the facts then known. His idea was that the region grew, by a series of gradual elevations connecting Paleozoic islands, into one landmass; that a great peninsula was developed running eastward from the Rocky Mountains and contracting the intercontinental Cretaceous ocean. Thus by the end of the Middle Cretaceous this ocean was divided into two gulfs, a northern and a southern, in which toward the end of that period the faunas became quite different. Finally, independent shallow basins were formed in which conditions for coal accumulation prevailed.

S. F. EMMONS.
U. S. GEOLOGICAL SURVEY.

(To be concluded.)

PHASES IN JAMAICAN NATURAL HISTORY.

PROF. J. E. DUERDEN,* Curator of the Museum of the Institute of Jamaica, has recently published an article which gives new and interesting data concerning the results of the introduction of the Mongoose to the Island.

*Contributions to the Natural History of Jamaica. By J. E. Duerden, Curator of the Museum of the Institute of Jamaica. Kingston, November, 1896.

The story of how the Mongoose was brought into Jamaica from India in 1872 for the purpose of destroying the imported European black and brown rats which were devouring the crops of the sugar-cane and other vegetal products, and how it increased until it became a veritable pest, is well known to history. The Mongoose thrived and exterminated the rats, and having enjoyed this diet, he began a series of food experiments upon all small domestic animals, especially poultry. In some instances, he even killed small pigs, kids, lambs, newly dropped calves, puppies, kittens. All kinds of game, such as partridges, quail, guinea-fowl, snipe, lapwing, ground doves, young buzzards, and all birds which nest on or near the ground, and their eggs were much to his taste, and he has been known to catch fish. He likewise, developed a special fondness for snakes, ground lizards, frogs, turtle and turtle's eggs, land crabs and other of the more humble creatures. Not only did his appetite crave the above animal diet, but it was rapacious in its assaults upon ripe bananas, pineapples, young corn, avocado pears, sweet potatoes, cocoas, yams, peas, and certain fruits. He even competed with his former enemy, the rat, in eating the sugar-cane, and did not hesitate in attacking salt meat.

As a consequence of the fecundity and omnivorous appetite of the Mongoose, Jamaica was soon rid not only of its rats, but of all the game and birds, except such, like the ground dove, as had the discretion to transfer their breeding places upon his advent, from the ground to the tops of the high prickly cacti. As a result of the Mongoose's tastes for reptiles, the twenty-two species of lizards and five species of harmless snakes, which had hitherto proved an inestimable blessing to the island in keeping down small insect pests such as the tick, fell victims to its depredations. Notwithstanding the humble sphere which the tick and chigor occupy in the scale of life, they were not so stupid as to fail to take advantage of this destruction of their hereditary enemies, and proceeded to thrive as they had never thriven before. These minute forms of life, which had previously confined their attention to cattle, increased so rapidly that they became a pest to mankind. One could not brush against the bushes or put his foot down in the grass without being covered by the small 'seed-ticks,' as the young are called.

As a final result of this series of wars between the various kinds of lower animals, the tick and Mongoose remained as the victorious survivors. So different were their spheres in life that it was generally concluded that their rule would continue undisputed for years.

Within the past few years, according to Prof. Duerden, another phase of the question appears to have been entered upon. He says: "It is reported from practically all parts of the island that the Mongoose is not nearly so plentiful as formerly. Some of those caught are found to be suffering from the attacks of ticks. The results of the diminution are shown in the appearance and marked increase of certain species of reptiles and birds; some already alluded to as supposed to have been exterminated. Amongst the snakes there is a very noticeable increase. During the past year several examples of the yellow snake have been received at the Museum, as well as notices of others. Specimens of the spotted-chinned snake are obtained almost weekly, especially from the vicinity of Kingston; and, occasionally, an example of the two-headed snake. During the last fifteen months, however, I have never heard of the occurrence in the island of an undoubted black snake nor of the pardaline snake. Perhaps the most obvious change, remarked by everyone, is the abundance of the ground

lizard, previously recorded as extinct. Hundreds are now to be met with on the outskirts of Kingston, where only a few years ago not one was to be seen. The woodslave is not rarely seen. Crocodiles are certainly more in evidence, especially on the south side; numerous eggs, young and adult forms being now brought to the Museum. There is not nearly the same outcry against the loss of poultry and domestic animals, particularly around the towns. Correspondents from the country state that bevies of quail are to be occasionally seen, and that the various pigeons and blackbirds are more numerous.

The attorney in charge of the largest sugar estate in the island gives information that lately more of his canes are being destroyed, due to an increase in the number of rats, and that ticks are not nearly so prevalent. There seems not the slightest doubt therefore but that the maximum influence, both for good and for evil, of the Mongoose, is passing away in Jamaica; first from the vicinity of towns, but not less surely from the country districts. Of the cause we can do little more than speculate at present.

The animals now returning in greater abundance were evidently never exterminated, but only extremely rare; so that, as their destroyer in the past is becoming less important, they are increasing towards their original proportions. New balances of life are being struck in the island, and further developments will be watched with interest."

ROBT. T. HILL.

U. S. GEOLOGICAL SURVEY.

THE INTERNATIONAL METEOROLOGICAL AND HYDROLOGICAL MEETINGS.

THESE were held last autumn in France, the first and more important being the International Meteorological Conference, which met at Paris, in the Hotel de la Societé d'Encouragement, September 17th to 23d, inclusive. It had the same official character as the similar conference at Munich in 1891, to which representatives of the principal meteorological services and observatories of the world were invited. There were at Paris about forty such representatives, besides several specialists who were invited to participate in the discussions. At Munich the United States Weather Bureau had two representatives, but at Paris, unfortunately, there was not one. Mr. J. Page represented unofficially the United States Hydrographic Office, and the writer represented the Harvard College and Blue Hill Observatories. No one came from either Spain or Brazil, as was the case at Munich, but Belgium, Canada and Mexico each sent a delegate to Paris, the two latter countries participating for the first time in an international meeting.

The meeting was called to order by Mr. R. H. Scott, secretary of the Permanent International Committee, and M. Mascart, director of the French Meteorological Office, was chosen president of the meeting. The programme of questions proposed for discussion was shortened by excluding questions which had been considered at previous Congresses or which were beyond the scope of this Conference. Action on some propositions was deferred and there was an unwillingness to aid anyone to influence his government. The postponed proposition for double thermometric stations was decided by recommending that a standard thermometer shelter be adopted in each country and that comparisons be instituted between it and other shelters, and especially the Assmann aspiration thermometer. Most of the questions were considered by sub-committees on meteorological telegraphy, instruments and methods of observations, cloud observations, terrestrial magnetism and atmospheric electricity, whose reports were substantially adopted by the Conference. Among the most important opinions expressed was a general recommendation by the first-named com-

mittee that the daily international dispatches to Paris be accelerated, so that they should be more useful in forecasting, pending the possible adoption of the American 'circuit system' in the European countries; the second committee refused to adopt either a standard anemometer or a uniform exposure for anemometers; and the third committee, after considering the delays which had occurred in commencing the international system of cloud observations in some countries, requested, when possible, that both nephoscope observations and theodolite measurements of clouds be continued throughout the year 1897, in order to obtain one whole year of observations for synoptic comparison. Probably the most noteworthy feature of the Conference was the attempt of the last named of the sub-committees to secure uniformity in magnetic surveys, and as regards instruments and methods of reduction both in the field and at the permanent stations. Resolutions were adopted favoring the use of captive balloons, free balloons, and unmanned, or pilot balloons for obtaining meteorological data in the upper air. Simultaneous ascents in the different countries and the prompt publication of the original observations were recommended. The success of kites at Blue Hill Observatory for elevating self-recording meteorological instruments led to the expressed desire that similar experiments should be made elsewhere.

The Conference reappointed the International Meteorological Committee, which was elected at Munich, except that three vacancies caused by resignations were filled. This committee of 17 is thus constituted: von Bezold, of Prussia; Billwiller, of Switzerland; de Brito-Capello, of Portugal; Davis, of Argentine Republic; Eliot, of India; Hann, of Austria; Hepites, of Roumania; Hildebrandsson, of Sweden; Mascart, of France; Mohn, of Norway; Moore, of the United States; Paulsen, of Denmark; Russell, of New South Wales; Rykatcheff, of Russia; Scott, of Great Britain; Snellen, of the Netherlands; Tacchini, of Italy. M. Mascart is the President, and Mr. Scott retains the position of Secretary to the Committee, which he has held for many years. The Committee appointed commissions to deal with problems relating to solar radiation, terrestrial magnetism and atmospheric electricity, cloud observations and meteorological aëronautics. The United States is represented in the two last-named commissions by the writer. French, English and German reports of the Conference will be published, respectively, by Messrs. Mascart, Scott and von Bezold. The date of the next conference was fixed five years hence, the place of meeting to be named by the International Committee.

During the Conference the meteorological institutions of Paris and its suburbs were visited. These included the Central Meteorological Office with its station on the Eiffel Tower and its meteorological and magnetical observatory at the Parc Saint Maur, the municipal observatories of the Tour Saint Jacques and Montsouris, and the new private observatory of M. Teisserenc de Bort at Trappes, which is devoted to dynamic meteorology and at present chiefly to the measurement of cloud heights by photography. The pleasantest feature of the Conference was the cordial relations which existed between all the members, and these were especially noticeable in the case of the French and Germans. At a breakfast given by M. Mascart on the Eiffel Tower, M. Rambaud, the Minister of Public Instruction, under whose patronage the Conference was placed, spoke of the international character of all science, but especially meteorology, since the air which we breathe belongs to no country and can be monopolized by no one.

The Fourth International Congress of Hydrology, Climatology and Geology,

which has been noticed already in SCIENCE, met at Clermont-Ferrand, in the Department of the Puy de Dôme, between September 28th and October 2d, inclusive. The first session was at Biarritz in 1886, but the geological section was added this year. The present Congress, open to anyone on payment of a fee, was attended by about two hundred persons, of whom more than half were French physicians, but its international title was sustained by the presence of official delegates and representatives of eleven other countries. The Congress was under the patronage of the Minister of the Interior who delegated Prof. Proust, general inspector of the Sanitary Services. Dr. de Ranse and Dr. Fredet, president and general secretary, respectively, of the Committee of Organization, retained these offices for the meeting. The foreign honorary president, chosen by acclamation, was Dr. Berthenson, of Russia, the foreign honorary vice-presidents being Prof. Ludwig, of Austria, Prof. Kuborn, of Belgium, and Mr. Rotch, of the United States.

The Congress met in three sections, but, as might be expected, the chief interest was in the hydrological section. The Committee of Organization had prepared printed reports upon questions pertaining to each section, which were read and discussed. The majority of the papers presented afterwards treated of the therapeutic properties of thermal and climatic stations, but there were three conferences on the history of hydrology, the geology and the climate of the region. The proceedings will be published under the direction of the Committee.

Outside the University, where the meetings were held, there was much to be seen, and in a volume specially prepared for the occasion the historical and physical features of the province of Auvergne were described. Unfortunately, the cold, rainy weather proved a drawback to sight-seeing. The climatological conference was given on the Puy de Dôme, at the observatory, which, built twenty years ago, was the first well-equipped mountain meteorological station in Europe. During the Congress, an exhibition of objects illustrating the neighboring thermal stations was open at Clermont. Entertainments were given by this municipality, and at a banquet offered by the management of the Thermal Establishment at Royat some international courtesies were exchanged. After the close of the Congress the more distant thermal stations were visited. The next session is intended to take place at Brussels in 1898.

A. LAWRENCE ROTCH.

A PROPOSED BUREAU OF PLANT REGISTRATION.

THE question of establishing a bureau for the registration of plants, in connection with the present Division of Pomology, was brought before the Section of Botany and Horticulture at the recent meeting of the Association of American Agricultural Colleges and Experiment Stations, by Prof. L. C. Corbett, of the West Virginia University. After a careful consideration of the matter, the Section appointed a committee to report upon the feasibility of the scheme, and to suggest the outline of a plan to be presented to Congress at an early date. The committee consisted of L. C. Corbett, Morgantown, W. Va., Chairman; W. A. Taylor, United States Department of Agriculture, Washington, D. C.; Prof L. H. Bailey, Ithaca, N. Y.; F. S. Earle, Auburn, Ala., and C. H. Shinn, Berkeley, Cal.

The idea is to have some one place in the United States where all plants placed upon the market can be officially registered, numbered, and a description, together with specimens of the bloom, seed, foliage and fruit, placed on record. When it is not practicable to preserve the original, colored casts are to be prepared, as in the case of

citrons, drupaceous and pomaceous fruit, as well as vegetables.

In all cases where plants are sent for registration, specimens of flowers, foliage, fruit, root, tuber or seed must accompany the application. All vegetables must be accompanied by a given amount of seed (to be determined) to be preserved for purposes of noting the duration of cultural varieties, the influence of climate during any series of years or in any locality. A further purpose of the seed shall be to grow plants for purposes of identifying the sort.

ENDS SOUGHT.

1. To discourage the duplication of names, and the re-naming of old sorts for commercial purposes.

2. To form a National herbarium of economic plants, which shall be made up largely of type specimens.

3. To simplify the matter of nomenclature.

4. To aid the student of varieties as well as of variation of plants under culture.

5. To secure the originator of a truly valuable variety some reward for his labor, the same as is now accorded the inventor.

The incorporation of such a clause (No. 5) will undoubtedly secure the hearty cooperation of all plant breeders, nurserymen and seedsmen, and this coöperation we must have in order to advance the scientific ends sought.

It is further proposed that this central bureau be made a part and parcel of the present Division of Pomology of the United States Department of Agriculture. A very valuable nucleus for the beginning of such work is had in the fruit models now in the museum of that department.

Each person interested in this matter will kindly formulate his ideas on the subject and send to some member of the committee who will put them in such form that a bill may be drafted at an early date and presented before Congress. The idea in having the members of the committee so scattered is to get the needs of the several sections of the United States as well represented as practicable. It is hoped that each one interested will lend hearty coöperation in the matter.

CURRENT NOTES ON PHYSIOGRAPHY.

PHYSICAL FEATURES OF MISSOURI.

THE current annual volume of the report of the Missouri Geological Survey contains an essay on the physical features of that State by C. F. Marbut(Vol. X. 1896, 14–109). The general upland of the State, bevelled obliquely across the nearly horizontal strata, is explained as a peneplain produced by subaerial erosion that continued into Tertiary time; the peneplain now being dissected in consequence of a warping uplift of middle or late Tertiary date. Apart from the narrow valleys by which much of the upland is dissected, the most notable features of the State are the escarpments that are formed on the retreating edges of the harder strata. A number of these are described, mapped and figured. The most important are the Bethany escarpment, formed on the resistant members of the upper coal measures in the northwest corner of the State; the Burlington escarpment, on the Burlington limestone in the southwest; and the Avon, Crystal and Burlington escarpments on a series of hard strata near the confluence of the Missouri and the Mississippi, below St. Louis. The lower ground that spreads out in front of an escarpment is called a platform; the upland, to which the escarpment rises, descends again in a back-slope or structural plain. The relief form included by the back-slope and the escarpment is called a ridge; the special term, *cuesta*, might be introduced to advantage. The drainage system of the State is discussed at some length, with special reference to the origin of incised

meanders. A brief and elementary presentation of the problems here discussed elaborately would be very serviceable to the schools of Missouri.

THE GLACIERS OF NORWAY.

Two previous notes on Norwegian essays by Richter, of Graz, have been given in these columns. His latest article concerns the Norwegian glaciers (Hettner's Geogr. Zeitschr. II., 1896, 305–319), a subject on which he is particularly well qualified to write after his minute studies of the glaciers of the eastern Alps. The Folgefond highlands have about a sixth of their area ice-covered; this part being comparatively smooth, while the rest is much more dissected. Hence it is argued that the inactive ice sheet has been protective of the highland surface. Richter places the snow line here at 1,450 met., dissenting from the estimate of 1,025 by Sexe. The descending glacial branches from the highland ice sheet vary in shape according as they form broad ice paws in the high-level, shallow, upland valleys, or long, steep, slender ice tongues in the deep fiord valleys. The Folgefond has only two or three glaciers of the second class, and twenty or thirty of the first. These two classes should not be paralleled with glaciers of the first and second order in the Alps. The highland from which the Jostedals glacier descends, for which Richter suggests the name Jostefjeld, possesses a number of round and peaked summits (1,900 met.) that rise above its general level (1,600). While the latter is ice-covered, the former are bare; and this difference is ascribed to wind action. The snow line here stands at 1,600–1,650 met. Langefjeld and Jotunfjeld are also described.

LANDSLIPS IN SWITZERLAND.

ONE of the frequent landslips and torrent washes of the Alps occurred last May on the south slope of the Rothorn ridge, near the east end of Lake Brienz. It is described by H. V. Steiger (Mitth. Naturf. Gesellsch., Bern, 1896, with illustrations). The Lammbach has here built a large alluvial fan between the villages of Kienholz and Hofstetten, on which it from time to time spreads floods of stone and gravel, fed by landslips in its headwater ravines, where rifts in the upper ground show that a repetition of such disasters may be expected for years to come. The length of the recent stony torrent from its source to the lake is $3\frac{1}{2}$ k.; its breadth where widest near the lake, 120 m.; its thickness at the same place, $2\frac{1}{2}$–3 m., increasing up stream to 4 m. The advance of the wash was at a variable rate, sometimes so slow that the grass in front of it was saved by mowing. On escaping from the incised upper valley, the torrent turned sharply to the right on the lateral slope of the fan. Its spreading lower course is well shown in a large photo-print. Although even these small slips are of economic importance in a closely occupied country like Switzerland, they are insignificant compared to the colossal Topinish and Simcoe landslides in Washington, described by Russell (Bull. 108. U. S. G. S.).

HEILPRIN'S EARTH AND ITS STORY.

'THE Earth and its Story,' by Prof. Heilprin, of the Academy of Natural Sciences of Philadelphia, is a 'first book of geology' (Silver, Burdett and Co., Boston, 1896, 266 pp.), in which there is a decided physiographic flavor, thus giving much support to the contention of the report of the 'Committee of Ten' that geology proper– the study of the Earth in relation to time—may be well left over to collegiate years, while physiography supplies the natural preliminary training in the high school. The book is simply written, and its chapters follow a well-chosen order. The illustrations are as a rule good, but in some cases there is here, as in many recent books, an example of the too great confidence in 'process' reproduc-

tion of photographs. The upper half of Plate 20 reduces Holmes' drawing of the shore lines of Lake Bonneville, from Gilbert's monograph; the lower half represents the floor of an extinct lake in the Swiss valley of Engelberg, from a photograph; and the first is distinctly more educative than the second. The Delaware and Grand Rivers, Plate 16, are not successful reproductions; good drawings would be more instructive, even if less accurate than the original photograph; but good drawings cost too much nowadays. Brevity of treatment in a number of passages calls for the aid of a good teacher before the student will understand the problems discussed.

W. M. Davis.

Harvard University

CURRENT NOTES ON ANTHROPOLOGY.

AMERICAN GAMES AS EVIDENCE OF ASIATIC INTERCOURSE.

In the Internationales Archiv für Ethnographie (Bd. IX., Supp.), Dr. E. B. Tylor returns with fresh zeal to his ancient contention that the presence of two games so much alike as *parcheesi* in India and *patolli* in Mexico shows intercourse between the continents before the time of Columbus.

This betrays a regretable misconception of the principles of ethnology as now adopted by its foremost students. Games are alike because men are alike the world over. The same similarity extends to myths, social constructions, laws and arts. That Lewis F. Morgan, forty years ago, should insist that the Iroquois of New York learned their totemic system from East Indians was pardonable in that day. Now it scarcely would be.

Dr Tylor should also study his ethnography closer. The Tarahumaras are not 'a distant people of an alien language' to the Aztecs, but closely related and speaking a tongue of the same Uto-Aztecan stock. That is why they call the game *patole*.

RACIAL STUDIES IN SWITZERLAND.

In the first number of the new Swiss 'Archiv für Volkskunde,' Dr. Rudolph Martin, of Zurich, urges a complete and careful study of the living adult population of Switzerland, "in order to determine what types represent pure varieties, and what others indicate hybrid forms."

He proposes that the observer should use only a few simple implements, an anthropometer and a calliper, costing together about 85 francs. These, he suggests, could be provided by a society and loaned to observers who would find it inconvenient to purchase them.

His paper is supplemented with blank forms, showing what observations are desirable. These give the individual's name, age, birthplace, etc.; then his measurements, 28 in all; and his descriptive criteria, color of hair, eyes and complexion, shape of head, face, nose, etc. These items he believes would be ample for the purpose.

D. G. Brinton.

University of Pennsylvania.

SCIENTIFIC NOTES AND NEWS.

Dr. Emil Heinr. DuBois-Reymond, professor of physiology in the University of Berlin, died on December 26th, at the age of seventy-eight years.

The Emperor of Germany has conferred upon Dr. Roux the Royal Order of the Prussian Crown of the second class, which is said to be the highest decoration in his gift. It will be remembered that this order was conferred upon Pasteur some two years ago and declined by him. The German Emperor has in this case shown tact in conferring the order on one who in many ways is Pasteur's successor, and who it is understood will accept it. Dr. Behring, the discoverer, with Dr. Roux, of the antidiphtheretic serum, has had the Grand Order of the Crown of Italy conferred on him.

The Czar of Russia has conferred on M. Gérard, director of the Municipal Laboratory,

Paris, the Cross of the Commander of the Order of St. Anne; the Cross of St. Stanislas on Dr. Bordas, sub-director of the laboratory, and on Dr. Bertillon, director of the anthropometric service.

PROF. E. ABBE, of Jena; Prof. R. Fittig, of Strasburg, and Prof. J. Wislicenus, of Leipzig, have been elected corresponding members of the Berlin Academy of Sciences.

MR. RICHARD RATHBUN has been appointed assistant in charge of the Smithsonian Institution to succeed the late Mr. W. C. Winlock.

M. PERROTIN has resigned from the directorship of the Observatory in Nice to accept a position in the Astro-physical Observatory at Meuden.

NINE works are placed in competition for the Lobachévski Prize at Kazan, Russia, of which three are from America. It is probable that the prize will be awarded to the Third Volume of the 'Theorie der Transformationsgruppen,' by Sophus Lie.

IT is stated in *Natural Science* that the Geological Society of Stockholm has completed twenty-five years of active life, and the fact is commemorated in a special number of its Förhandlingar.

MR. F. W. STOKES, an artist who accompanied the Peary expedition of 1892 and the North Greenland expedition of 1893-4, is now exhibiting at the Fifth Avenue Art Galleries, New York, paintings of Arctic scenery.

LADY PRESTWICH has given to the British Museum the collection of fossils of the late Sir Joseph Prestwich.

THE Arctic Club held its annual dinner in New York on December 26th, Prof. W. H. Brewer presiding. Dr. Frederick A. Cook stated that he was beginning the work of organizing an expedition to the Antarctic regions.

WE are asked to state that the time for the sending in of essays for the Welby prize is extended to January, 1898. Prof. Émil Boviac has been added to the committee of award.

THE Biological Society of Washington has elected officers for the ensuing year as follows: President, L. O. Howard; Vice-Presidents, Richard Rathbun, C. D. Walcott, B. E. Fernow, F. V. Coville; Recording Secretary, Charles L. Pollard; Corresponding Secretary, F. A. Lucas; Treasurer F. H. Knowlton.

PROF. CHARLES R. CROSS, of the Massachusetts' Institute of Technology, began on December 29th a course of eight lectures at the Lowell Institute, on the X-rays of Röntgen and related Phenomena of Electric Discharge.

THE Texas Academy of Sciences have sent out a preliminary program for the formal meeting in San Antonio on December 31st. Papers were promised by Mr. Thomas Fitz-Hugh, Dr. C. F. Francis and Mr. W. W. Norman, and addresses by Maj. C. E. Dutton and Dr. G. B. Halsted, the President of the Academy.

AN international exhibition for hygiene, alimentation and industrial art will be held at Lille during the months of March and April, 1897.

FOLLOWING the explosion of acetylene in M. Pictet's laboratory at Paris, another serious explosion has occurred in Berlin, kiling Mr. G. Isaac and three assistants, who were experimenting with acetylene.

THE anthropometric system for the identification of habitual criminals has been extended to Ireland, so that it is now in operation throughout the United Kingdom.

DR. S. C. CHANDLER states in the last number of the *Astronomical Journal* that, feeling the desirability of counsel and collaboration in the conduct of the *Journal*, he has invited Prof. Asaph Hall and Prof. Lewis Boss to share in its editorship, and they have accepted.

Harper's Magazine for January contains an illustrated series of articles on the progress of science during the century, by Dr. Henry Smith Williams.

WITH its issue of last week the New York *Medical Record* completed its fiftieth volume. Since its foundation it has been edited by Dr. George F. Schrady and published by William Wood & Co. The *Journal* has grown with the advance of medical science, to which it has in no small share itself contributed.

THE New York Board of Education has appointed 150 physicians to act as medical inspectors, one for each school district in the city.

This action will undoubtedly lead to a diminution of contagious diseases among children.

According to the *British Medical Journal* the Italian General Medical Council has presented a request to the government to the effect that all foreign doctors should be prohibited from practicing in Italy.

An exhibition will be held early next year at the Imperial Institute, London, illustrating progress in sea-fishing, yachting and life-saving appliances.

The Secretary of the Interior has recommended, through the Treasury Department, an increase in the salaries of the Commissioner of Education and of some other officers of the Bureau. The present Commissioner, Dr. W. T. Harris, to whom education and philosophy in America is so greatly indebted, receives an annual salary of $3,000 only, which is no more than that of some of the principals in the New York City public schools. There seems no reason why the Commissioner of Education should not receive as high a salary as the Commissioners of Indian Affairs or of Railroads, for as Mr. Francis, the Secretary of the Interior, writes: "The dignity of the Bureau of Education is certainly equal to that of other Bureaus of the Department, and the character of the work done therein is certainly of no less importance."

A case of alleged telegony was exhibited by Mr. Chalmers Mitchell at a recent meeting of the London Zoological Society. Sir Everett Millais, who has had much experience in the breeding of dogs, believed it to be a case of reversion, and so explained all cases of reputed telegony. Mr. Tegetmeier, who has also had much experience in breeding, concurred in this conclusion. At the same meeting Mr. Leonard Hill reported that he was unable to confirm Brown Séquard's results on the Inheritance of Aquired Characteristics following division of the cervical sympathetic nerve.

A recent issue of the Washington *Star* contains an account, by Mr. Frank G. Carpenter, of a trial of Prof. Langley's Aerodrome witnessed by him on November 28th, together with an interesting interview with Prof. Langley on his researches. On the day in question the aerodrome was launched from a boat in the Potomac River about 30 miles below Washington, and flew nearly a mile in 1¼ minutes, when it gently rested on the water. Its flight was only limited by the exhaustion of the water, less being used than the machine could carry. Prof. Langley is reported to have said: "I have proved both theoretically and practically that machines can be made which will travel through the air. The question of the development of the fact is one of the future. My motive and interest in the work up to this time have been purely scientific ones, but if I had the time and money to spend upon the construction of a large machine I believe I could make one on a scale such as would demonstrate to the world that a large passenger-carrying flying machine can be a commercial as well as a scientific success. There are many things yet to be learned concerning it, but I have no doubt that they will be discovered in the future. The moment that men see that such machines are not only practicable, but that they may be made commercially profitable, there will be a thousand inventors working upon the problem where there is now one. I believe, however, that the flying machine will first come into national use in the arts of war rather than those of peace. In an event of a great war by means of an aerial machine the armies of one nation will be able to know exactly what those of the enemy are doing, thus radically changing present military strategy and tactics, to say nothing of their power of dropping down bombs out of the sky. I believe, however, that such inventions will finally be of even greater advantage in the arts of peace. I have faith that the swiftest, and perhaps the most luxurious, if not the safest, traveling in the future may be through the air."

We recently noted the transfer of the publication of the *Botanical Gazette* to the University of Chicago, where it is printed in an enlarged form and with the highest degree of typographical excellence. In the current number of the *American Naturalist* Dr. Bessey gives some interesting details in regard to the evolution of the journal. It first appeared twenty-one years ago, in November, 1875, under the name of the *Botanical Bulletin*, edited by John M. Coulter, then professor of Natural

science in Hanover College, Ind. It consisted of four pages and the first volume contained only 52 pages of short and mostly local notes. The name of the journal was changed to the *Botanical Gazette* at the end of the second volume, and M. S. Coulter become one of the editors. In 1883 the editorship was undertaken by the present editors, John M. Coulter, Charles R. Barnes and J. C. Arthur, under whose control the journal has steadily improved up to the present time, when the name of G. F. Atkinson, V. M. Spalding, Roland Thaxter and William Trelease have been added as associate editors. As Dr. Bessey says, the *Gazette* "has thus been a growth, and it represents to-day much more than so many pages of printed matter. It has grown and developed as the science of botany has grown and developed in this country. When we look over the earlier volumes with surprise at the little notes which fill the pages we must not forget that American botany had not then generally risen above such contributions. It is true that we had a few masters in the science, with Dr. Gray still in his prime, but these masters wrote little for general reading, and their technically systematic contributions were mostly published in the proceedings of learned societies. The one thing which stands out to-day in sharp contrast with the botany of two decades ago is the very great increase in the number of masters in the science who are making liberal contributions from many different departments. The many-paged *Gazette* of to-day, with its rich variety of matter, differs no more from the four-page *Bulletin* of 1876 than does the botany of the two periods."

UNIVERSITY AND EDUCATIONAL NEWS.

IT is reported by cablegram that Alfred Nobel, the Swedish engineer and chemist, who died at San Remo, Italy, on December 9th, left a will bequeathing his entire fortune, amounting to about $10,000,000, to the Stockholm University.

THE will of the late Henry L. Pierce, distributes about three and a-quarter million dollars in public bequests, which include $50,000 to Harvard University and $50,000 to Massachusetts Institute of Technology.

DR. JOHN J. MCNULTY has been appointed professor of moral and intellectual philosophy in the College of the City of New York.

THE new catalogue of Harvard University shows a registration of 3,674 students, an increase of 74 over last year. There has been a slight decrease in the College, but a gain in the Lawrence Scientific School, in the Graduate School and in the Medical School. There has been an increase of 4 professors and 17 instructors.

AT Cambridge University the report of the General Board of Studies, recommending that steps be taken for the immediate appointment of a professor of mental philosophy and logic, was opposed upon financial grounds and because the establishment of the professorship was not urgent. The report was, however, adopted, by 120 votes to 70. The offer of Prof. Sidgwick to reduce his stipend as professor of moral philosophy from £700 to £500 per annum from the time of the appointment of the professor of mental philosophy and logic until midsummer, 1902, or until his chair be vacated, if that should occur before midsummer, 1902, was accepted.

DISCUSSION AND CORRESPONDENCE.

VAN BENEDEN AND THE ORIGIN OF THE CENTROSOME.—A CORRECTION.

I WISH to correct an error in my recent book on 'The Cell,' which misrepresents Van Beneden's early views regarding the origin of the centrosomes in the fertilized egg. At page 157 the view, or rather surmise, is attributed to him that, in the fertilization of *Ascaris*, one centrosome of the first cleavage-amphiaster is derived from the egg, the other from the spermatozoon. I am indebted to my friend, Prof. Conklin, for pointing out that through a misapprehension of Van Beneden's meaning I am in error on this point. Van Beneden did not, in fact, commit himself to any positive conclusion, but at page 272 of his paper of 1887 expressed the opinion that both attraction-spheres, and hence by implication both centrosomes, were derived from the egg, *i. e.*, from the second pseudo-karyokinetic (maturation) figure. Later researches, it is true, have almost conclusively shown that this opinion cannot be sustained;

but this does not lessen my regret at having unintentionally misrepresented the views of the distinguished leader of cell-research for whose splendid discoveries every investigator must feel such admiration.

Edmund B. Wilson.

Columbia University,
New York, December 19, 1896.

THE VELOCITY OF A FLIGHT OF DUCKS OBTAINED BY TRIANGULATION.

Measurements of the heights and the velocities of clouds are now being made at the Blue Hill Meteorological Observatory by Mr. Rotch as a part of an international scheme for such work. The measurements are made with specially constructed theodolites in which a large conical tube, with crossed wires at one end and an eye-piece at the other, replaces the ordinary telescope.

On the morning of December 8th, while Mr. S. P. Fergusson and I were engaged in measuring clouds, a flock of ducks passed across our base-line, which is 2590.3 metres (8496 feet) in length. We succeeded in getting one simultaneous set of measurements on the apex of the flock from which its height was calculated, and one or two independent subsequent observations, from which the velocity was calculated. The height was 958 feet above the lower station, which is situated in the valley of the Neponset river, above which the ducks were flying.

The velocity of flight calculated from this measurement of height, and from the angular velocity measured at one end of the base-line is 47.9 miles in an hour, and from the angular measurements made at the other end of the base-line is 47.7 miles an hour, making a mean of 47.8 miles. The wind was very light, having a velocity of only two miles an hour according to the automatic record made at Blue Hill Observatory, 615 feet above the valley station. The direction of the wind was from the north, and the ducks were flying from the northeast. These observations were not in our program, but they may prove of interest to ornithologists and students of aëronautics.

H. Helm Clayton.

Blue Hill Meteorological Observatory,
Readville, Mass., December 21, 1896.

A TEST ON DIVERSITY OF OPINION.

To the Editor of Science: It is always interesting to test diversity of opinion, particularly on questions of exact reasoning. It is quite difficult to obtain a test which is at once significant and general. I should be very much indebted to those of your readers who would be willing to send me answers to the following request.

Here is a piece of reasoning which is certainly capable of arousing criticism:

Granted that A is B, to prove that B is A.

B (like everything else) is either A or not A.

If B is not A, then by our first premise, we have the syllogism:

A is B;
B is not A;
∴ A is not A; which is absurd.

Therefore, B is A.

Is this reasoning correct or is it not? If regarded as correct, my request is to have the reasons for its correctness given as explicitly as possible. If it is regarded as incorrect, I wish in the same way a very explicit statement of the nature of the error. Answers are requested from all who are interested in the matter. I am particularly desirous of receiving replies from those whose interest in thought is a philosophical one, as well as from those who are more specially devoted to scientific pursuits.

Joseph Jastrow.

University of Wisconsin,
Madison, Wis., December 5, 1896.

SCIENTIFIC LITERATURE.

A Geographical History of Mammals. R. Lydekker. Cambridge Geographical Series. Cambridge (England) University Press. 8° pp. 400, col. map and figures in text. September, 1896. For sale by The Macmillan Company, 66 Fifth Ave., New York City. Price, $2.60.

The subject of the geographic distribution of animals is not one to be mastered in a few weeks or months, and many are the pitfalls that lie in wait for the author who seeks to illumine its difficult problems. It is rare, indeed, that a writer in his first essay on this theme suddenly leaps to a position of authority, yet this is precisely what Mr. Lydekker has done. He has approached the subject from a new direction—

that of the extinct ancestors of existing faunas —and has brought together a multitude of significant facts which no one but a paleontologist could safely venture to attack. The result is a volume which, in spite of the imperfections and errors incident to so great an undertaking, will rank among the standard works on Geographic Distribution for many years to come.

The influence of man on the dispersion of animals is excellently told. Mr. Lydekker says: "Probably ever since man has existed in any numbers on the globe he has been exerting a more or less strongly-marked influence on the distribution of animals, either by destroying them or by conveying them to countries or districts which are not their natural home. By the involuntary aid of man the common rat and mouse, which belong to a genus unknown in the New World, have been conveyed to every country in the globe; while the rabbit has been carried to the antipodes, where it has flourished and increased in an unprecedented manner. Cattle and horses have been introduced into South America, Australia and other countries where they were naturally unknown, and by their rapid increase have shown that the absence of particular animals from particular districts is not necessarily due to their being unsuited to live there, but rather to the fact that they have been unable to find their way thither. The fallow-deer, again, has been imported from its Mediterranean home into England and other countries of northern Europe; while goats and pigs have been carried to a number of oceanic islands, where they have done irreparable harm in exterminating the native fauna and flora." Sheep also might have been mentioned among the potent destroyers of native floras. "In all these instances," Mr. Lydekker continues, "the fact of the introduction has always been more or less clearly known, and therefore no difficulty arises as to what are native and what are introduced forms. Very different, however, is the case with the Islands of the Malay Archipelago, where the natives, who have a wonderful facility for taming animals, have carried a species peculiar to one district or island to localites where it is quite unknown as a native; and in consequence of this transportation and acclimatisation it is probable that several mammals have been given a habitat to which they have not the most remote right. To the Malays is due the introduction of the small civet known as the rasse into Madagascar. Whether the dingo, or native dog of Australia, was introduced at an exceedingly remote era by the original colonizers of that island, or whether it is truly indigenous, is a question that will probably never be decisively answered. It is likewise quite impossible to say what part man may have played in the extermination of the large mammals that inhabited Europe about the close of the glacial period, but it seems quite probable that he may have had a considerable share in their destruction. Be this as it may, the domestication of certain mammals, has undoubtedly had the effect of destroying the wild race, as is remarkably exemplified by the two existing species of camel, of neither of which do we know the original habitat." (pp. 16-17.)

In treating of barriers to dispersion Mr. Lydekker revives the fallacy that "high mountain ranges form an effectual barrier to the migration of mammals," but he cites no examples. It is true that in many instances, as in the Himalaya, mammals inhabiting the lands on opposite sides of the mountains are widely different. But this is due to a radical difference in the climates or physical features of the countries themselves, and not to the presence of the intervening mountains. Does any one know of the existence of a mountain range in the whole world which is continuously high enough and long enough to keep mammals from crossing it or passing around it if the country on both sides is suitable to their needs? Mountains are barriers to distribution only so far as their own mass is concerned.

While expressing his general adherence to the view that after mechanical barriers, such as oceans, temperature is the chief factor in fixing the limits beyond which species and genera do not pass, he cites as exceptions the time-worn cases of the puma and tiger, using these names in the sense of species. He says: "There are several species, more especially among the carnivorous mammals, which seem quite independent of both station and temperature, the New World puma ranging from Patagonia to Canada, while the tiger inhabits alike the burning jun-

gles of India and Burma, and the Arctic tundras of Siberia." It may be poetic license, but hardly scientific truth, to speak of the tiger as an inhabitant of 'Arctic tundras.' And Mr. Lydekker must be aware that the northern tiger differs so markedly from the southern that it is regarded by some naturalists as a distinct species and has received a distinctive name. Our American puma also is a composite beast, differing widely in different parts of its range.

Other cases of the same sort that have been often cited are those of the wolf and ermine weasel. In discussing this subject five years ago I said: "With the possible exception of the gray wolf, not a single species of mammal ranges throughout the Sonoran and Boreal Zones, though a number are common to the Upper Sonoran and Lower Boreal (Canadian); and in the case of the wolf it is almost certain that comparison of specimens will show the animal of the southern United States and Mexico to be perfectly distinct from that of Arctic America. The ermine is another species of phenomenal though less extensive range, if it is really true that the weasel inhabiting the shores and islands of the Polar Sea is specifically identical with that found in the more elevated parts of the Southern States—an assumption I cannot for a moment entertain."*

Since this was written it has been found that the northern and southern wolves are very different, and that the weasels inhabiting North America from the Arctic barren grounds to Mexico belong to no less than five different species, each characteristic of a particular climatic belt!

That Mr. Lydekker is a 'lumper' of species is well known, and is exemplified by his statement that in North America we have only a single species of porcupine (*Erethizon*) and only one of little spotted skunk (*Spilogale*)! The way he unites European and American mammals has been pointed out in this JOURNAL in reviews of his earlier works.† In the present volume he maintains his reputation in this direction, stating or implying that Eurasian and American wolverines, martens, wolves, foxes, bears, lynxes, moose, reindeer and sheep are not specifically separable. With respect to the sheep he says: "The Kamschatkan wild sheep is so closely related to one race of the big-horn, or Rocky Mountain sheep that it is very questionable whether the two are really entitled to specific distinction." If Mr. Lydekker will take the trouble to glance at the skulls of these two animals, or even at the rather crude figures published by Guillemard in the Proceedings of the Zoological Society of London for 1885 (pp. 676–677), I do not think his faith in their distinctness will ever again be shaken.

Of the lesson to be learned from cases of discontinuous distribution, Mr. Lydekker states: "Examples of 'discontinuous distribution' among genera are of the very highest import to the science, since they clearly indicate that some of the lands lying between its present disconnected distributional areas must have formerly been the habitat of the genus, and thus enable important conclusions to be drawn as to the former land connections between such areas." But at the end of the book he implies his belief in the dual origin of both species and genera. He says: "The suggestion that *Equus* has thus been independently evolved in the two areas has been already mentioned, and this idea receives support from some very remarkable observations recently made on the invertebrates inhabiting certain European and North American caves * * * if animals which appear to belong to one and the same species can be proved to have had a dual origin in the one case, it can scarcely be considered impossible that similar instances may occur in the other. And if such dual origins exist among species, there is surely no reason why they should not occasionally occur in the case of genera. It would, therefore, seem by no means improbable that the species of the genus *Equus*, which inhabited the eastern and western halves of the northern hemisphere during the close of the Tertiary period, may have been evolved from the closely allied but separate ancestral equine stocks."

Respecting the geographic origin of types, the author holds the extreme view that "at least a very large proportion of the animals that have populated the globe in the later geological

*Proc. Biol. Soc. Washington, VII., 48, April, 1892.

†See SCIENCE, April 5, 1895, pp. 387–389; July 5, 1895, pp. 18–21.

epochs originated high up in the northern hemisphere, if not, indeed, in the neighborhood of the pole itself."

In some instances Mr. Lydekker calls particular attention to the widely different climatic conditions prevailing in Tertiary times from those of the same areas in our times, with consequent dissimilarities in past and present faunas; in other cases he assumes that the boundaries of existing faunas coincide essentially with those of the antecedent fossil faunas of the same area. Thus while explaining the great differences in the past and present life of the Arctic region on the ground of changes of climate, he would have us believe that the Sonoran region has maintained essentially its present boundaries since the days when it was inhabited by the remarkable extinct mammals known as Creodont Carnivora, Oreodont Ungulates, Protoceras, Camels, Titanotheriums, Coryphodons and others, all of which he regards as of Sonoran origin. While of much interest to know what types originated in this geographic area, does anyone imagine that its climate, when these extraordinary animals lived there, was the same as to-day?

But all this is preliminary. Coming to the real subject of the book Mr. Lydekker parcels off the globe into the following primary and secondary divisions:

I. Notogæic Realm.—1. Australian Region.
2. Polynesian Region.
3. Hawaiian Region.
4. Austro-Malayan Region.

II. Neogæic Realm.—Neotropical Region.

III. Arctogæic Realm.—1. Malagasy Region.
2. Ethiopian Region.
3. Oriental Region.
4. Holarctic Region.
5. Sonoran Region.

To discuss this scheme with the fullness its importance deserves would require far too much space for the limits of the present review. The primary regions, or 'realms,' may be passed without comment, inasmuch as few writers agree on their numbers or boundaries; and little will be said of the paleontological side of the book or of the facts of present distribution outside of the Americas.

Mr. Lydekker accords to South America the high distinction of primary rank, making it one of the three great 'realms' into which he divides the whole world. But he fails to see in its diversified faunas more than a single division of secondary rank—the 'Neotropical region'—whose boundaries he conceives to be coincident with those of the 'Neogæic realm;' and it is not until we come to divisions of the third rank, or 'sub-regions,' that he finds it necessary to take into account the widely different faunas that characterize the tropical forests, the grassy pampas and the lofty Andes. This seems scant justice, particularly by contrast with North America, where three full 'regions' are admitted. The number of Neotropical 'sub-regions' recognized is four, two of which—the Mexican and the Antillean—are northern outliers, leaving only two for the whole continent of South America. Of these, the first, or 'Brazilian subregion,' "is essentially an area of dense tropical forests, locally interspersed with open pastures or 'campos.' The second is the Chilian subregion, comprising Chili, Argentina proper, Uruguay, Patagonia and such portions of Peru and Bolivia as are not included in the preceding. It is chiefly an area of open plains and pampas, although including the high Andes."

If it could be assumed that Mr. Lydekker was unacquainted with the mammal faunas of South America, such a classification might be attributed to an imperfect knowledge of the facts, but his own enumeration of the characteristic genera and families of the different areas precludes this view and shows that the difficulty is mainly one of interpretation.

In speaking of the Mexican extension of the Tropical fauna, Mr. Lydekker makes the shocking statement: "Dr. Hart Merriam has proposed to unite Central America with the West Indies to form a separate zoological region—the Tropical—of equal rank with the Sonoran; but, however much may be urged in favor of this view, the multiplication of regions is much to be deprecated." It is hard to understand how any contortion of the imagination could give birth to such an overwhelming misconception. As a matter of fact, I simply remarked, after defining the Sonoran region, that the lowlands of Mexico, Central America and the West Indies belong to the American Tropical region—

without attempting any subdivision whatever—and using the term 'Tropical' in precisely the sense in which 'Neotropical' is commonly employed.

Another case of unintentional misrepresentation occurs on page 364 with reference to the peninsula of Lower California. At the end of a quotation from my Presidential Address on the Geographic Distribution of Life in North America he says: "The proposal to form a separate region for such an insignificant area as the southern extremity of California seems unnecessary, although its fauna may differ considerably from that of the typical Sonoran"—implying that I suggested its erection as a 'separate region,' whereas the rank I really gave it is the trivial one of a 'subdivision' of a 'zone.' I said: "The peninsula of Lower California is a subdivision of the arid Lower Sonoran Zone. Not a single genus of land mammal or bird is restricted to it and but two peculiar species of mammals have been described."*

In the same connection it might be mentioned that the only one of my papers on the life areas of North America quoted by Mr. Lydekker was published in the spring of 1892. Subsequent papers, containing certain modifications of the views expressed in 1892, together with much additional matter, are not referred to.

The part of the book which is probably of greatest importance is that which treats of the fossil vertebrates of South America. Mr. Lydekker has himself visited Argentina, and therefore should speak with authority. The paleontological discoveries of Ameghino in southern South America are of surpassing interest. Ameghino unearthed the fossil bones of a fauna which was not only previously unknown, but whose ancestry could not be clearly pointed to in any part of the world. The subsequent study of this fauna has developed some of the most interesting and far-reaching problems with which naturalists and geologists have had to grapple. These problems relate to the ancient land connections of South America and to the origin and lines of evolution of important groups of mammals and birds.

*Proc. Biol. Soc. Washington, VII., p. 29, April, 1892.

Our own distinguished paleontologist, Prof. W. B. Scott, in an address delivered a year ago before the Society of American Naturalists, stated that the earlier Miocene mammals of South America "are totally different from those of the northern land-masses, so much so that the correlation of horizons becomes a matter of extreme difficulty. The hoofed animals all belong to orders unknown in the north—*Toxodontia*, *Typotheria*, *Litopterna*—and the principal constituents of the fauna are immense numbers of *Edentates*, *Marsupials* and *Rodents*, with several platyrrhine monkeys. No artiodactyls, perissodactyls, proboscidians, Condylarthra or Amblypoda, neither Insectivora, Cheiroptera, Carnivora or Creodonta are known. The Edentates are all of the specifically South American type, sloths, armadillos and the like. The Rodents also are very much like those which still characterize the region, though most of the genera are distinct; they are all Hystricomorpha, neither squirrels, marmots, beavers, rats or mice, hares or rabbits occurring among them." (SCIENCE, February 28, 1896, 308.)

The total absence of the early South American types from the rich deposits of vertebrate fossils in the United States, and the corresponding absence of North American types from all but the later fossil beds of South America, prove clearly, as Mr. Lydekker says, that "there must have been a barrier between North and South America during the Oligocene and a portion or the whole of the Miocene." Scott has already told us that "in the Pliocene (Monte Hermoso) appear the first traces of the union with North America, in the presence of mastodons, horses, tapirs, deer, llamas and true carnivores, and from that time till far into the Pleistocene the intermigrations between the two continents kept up until a large number of common types had been established." Lydekker, speaking of the same event, says: "The presence of a glyptodont in the Nebraska stage of the Loup-Fork group in North America, and of northern forms in the Monte Hermoso horizon of South America, marks, then, the first commingling of the original faunas of the two halves of the New World. For the first time in the history of the southern continent this connec-

tion allowed of the immigration from the north of the true Carnivora, such as the existing cats (*Felis*), the extinct sabre-toothed tigers (*Machærodus*), dogs and foxes (*Canidæ*), bears (*Ursus* and *Arctotherium*), raccoons (*Procyonidæ*), skunks and their allies (*Mustelidæ*), together with various ungulates belonging to suborders previously unknown in the realm. These latter include the guanaco and vicuña (*Lama*), of which ancestral forms are abundant in the North American Tertiaries, New World deer (*Cariacus*), horses (*Equidæ*) of various genera, tapirs (*Tapiridæ*), peccaries (*Dicotylidæ*) and mastodons. Among the rodents, squirrels, the various genera of *Muridæ* and the hares, likewise at this epoch made their first appearance on the scene. Opossums also at this time effected an entrance into the land which has now become their chief home." (Pp. 119–120.)

Having arrived at the conclusion that the Pliocene and present mammal faunas of South America came from North America, and that the earlier faunas could not have been derived from the same source, Mr. Lydekker seeks to account for the origin of the latter. This, he freely admits, "is a difficult and perplexing subject which it is scarcely possible to explain fully in the present imperfect state of paleontological knowledge." Still, he agrees with Scott, Neumyr and others in the belief that the evidence points strongly to an early land connection with Africa and also with Australia. In the case of certain Patagonian marsupials he finds it difficult to come to any conclusion other than that their ancestors "reached the country from Australia, either by way of the Antarctic continent or by a land bridge in a more northern part of the Pacific." Continuing, he observes: "If this be correct, and likewise the supposition that the opossums originated from the ancestral stock in southeastern Asia, it will be evident that *Didelphys* and *Cænolestes* met in South America after their ancestors had travelled half around the world in opposite hemispheres."

Mr. Lydekker is evidently disturbed by his inability to define to his own satisfaction the Mediterranean region—the analogue of our Sonoran. He speaks of it again and again, but not always in the same way. Thus in one place (p. 310) he says: "Could a Mediterranean region be satisfactorily defined, the homogeneity of the mammalian Holarctic fauna would be still more apparent; but this, from the great mingling of northern and southern types which has taken place in the Old World, is, I think, impracticable." Again: "The Mediterranean or Tyrrhenian sub-region has strong claims to be regarded as representing a region by itself" (357). I have no doubt that sooner or later some enterprising naturalist will make a detailed study of this region, tabulate its distinctive genera and define its tortuous boundaries.

While it is not the purpose of the present review to criticise technical points in classification, one cannot help wondering on what characters the statement is based that the sewellels (*Aplodontia*) are 'closely allied to the squirrels.' On the other hand, it is pleasing to note that the aard-varks and pangolins are separated from the Edentates proper and given independent ordinal rank, under the name *Effodientia*. The lemurs are retained among the Primates—the usual and conservative course. Prof. Hubrecht has recently shown that the embryology and placentation of the Lemuroidea indicate that these animals are entitled to rank as an independent order, and that *Tarsius* is not a Lemuroid at all, but the earliest known Primate. He finds that the fossil genus *Anaptomorphus* of Cope is intermediate between *Tarsius* and the higher Primates, while *Tarsius* itself looks back to an ancestry suggesting the genus *Erinaceus* of the heterogeneous order Insectivora. Prof. Wilhelm Leche, from a study of the teeth, arrives at somewhat different conclusions.

The interesting and highly important subject of the geographic 'centers of evolution' is dismissed with a single page, where it is handled gingerly and in general terms only. In view of the standpoint from which the book is written —that of the paleontologist—it seems as if a chapter had been omitted—a chapter on the centers of origin, in time and space, of the different groups of mammals. Much information of this kind is scattered through the book, but it would be exceedingly convenient to have it epitomized by groups.

Evidences of haste in the preparation of Mr. Lydekker's book crop out here and there, par-

ticularly in the case of contradictory statements on different pages. For instance, on page 87 it is said that the Sonoran family *Geomyidæ* has only two genera (inferentially *Geomys* and *Thomomys*), while on the same page the genus *Heteromys* is added, and on a later page (366–7) no less than seven genera are enumerated as included within the family! Again, on page 342 it is stated that no member of the family *Geomyidæ* is found within the limits of the Holarctic region, while on page 366 we are told that the genus *Thomomys* of this family 'penetrates into the Canadian sub-region of the Holarctic.'

Lack of personal familiarity with the geographic distribution of living mammals in North America, and carelessness in examining current literature, have led to a number of additional errors. For instance, the genus *Spermophilus* is said to be restricted to the 'Holarctic' (= Boreal circumpolar) region, whereas we have one Tropical and at least a dozen Sonoran species, and two well marked Sonoran sub-genera. Again, the lynxes are said to be 'absolutely confined' to the Holarctic, while in the United States they range throughout the Sonoran and south into Mexico. *Zapus* also is said to be 'solely Holarctic,' although it is common as far south as the city of Washington. In the case of the rabbits it is stated that the greater number of species are Holarctic. In America the contrary is true, the greater number being Austral or Sonoran. We are told that *Notiosorex*, a genus of shrews, ranges south to Central America, but it is unknown from any point south of Mazatlan, in Mexico. Similarly the raccoons (genus *Procyon*) are said to occur 'over most parts of North and South America,' but in North America they are absent from the northern half of the continent.

The book is well printed and some of the illustrations are good; others, as, for instance, that of the tree-shrew (Fig. 61), look as if they might have been exhumed from the tombs of the ancients.

The work deserves a critical review from the paleontological side by some one competent to speak from the American standpoint. Then a revised and corrected edition should be brought out, for in spite of its imperfections, the book is probably the most useful contribution ever made, at least in the English language, to the subject of the distribution of the Mammalia, living and extinct. C. Hart Merriam.

The Elements of Electrochemistry. By Max Le Blanc. Translated by W. R. Whitney. Pp. x+284. New York, The Macmillan Company. 1896. Price, $1.50.

This volume is the English version of Le Blanc's *Lehrbuch der Elektrochemie*, which was published at Leipzig in the early part of this year.

The original met with a cordial reception, and this translation certainly deserves a warm welcome at the hands of those who are interested in the subject of which this book treats, but who are unable to consult it in the language in which it was written.

It has been the author's intention, averred in his preface, to 'write as clearly and simply as possible.' In this he has certainly succeeded.

The opening chapter brings an introduction to the fundamental principles of energy in general, and electricity in particular, which is most logically and lucidly written.

Next comes a chapter containing a brief but well balanced history of the development of electrochemistry up to the present time, and then follow able presentations of the Arrhenius theory of dissociation, the migration of the ions, the conductivity of electrolytes, electromotive force; a discussion of galvanic elements and accumulators forms the concluding chapter.

A careful persual of this treatise will certainly place its reader in possession of a clear and comprehensive view of the present state of this important subject—electrochemistry.

Comparison with the original shows the translation to be well done and fluent; the translator having wisely avoided too close an adherence to the author's style, which at times is a little ponderous.

Omission, in the English book, of the plus and minus signs, used by Le Blanc to specify the two kinds of ions, is to be regretted. On the other hand, valuable features introduced by the translator are the subject-index and the list of authors' names.

Ferdinand G. Wiechmann.

Columbia University.

SCIENTIFIC JOURNALS.

THE AMERICAN JOURNAL OF SCIENCE.

THE January number, beginning Volume III. of the Fourth Series, opens with an article on the *Worship of Meteorites*, by the late Prof. Newton. This article was delivered as a lecture in New Haven some eight years since, but has not before been published. In it the author has brought together a large number of facts showing the superstitious regard attached to meteorites from the very earliest times. The first case mentioned is that of the iron from an altar of an Indian mound in Ohio, which was preserved with other articles evidently regarded as of peculiar value. By some this iron is regarded as probably the same as that of which a number of masses were found about 1886 in Kiowa county, Kansas. Another case spoken of is that of the stone which fell at Ensisheim, in Alsace, in 1492, which was preserved in a church at that place. A fall of stones some nineteen years later near Milan, in Italy, is also alluded to as having probably been the occurrence recorded by Raphael by the fireball in his picture of the Foligno Madonna now in the Vatican. The sacred stone of the Mohammedans preserved in the Kaaba of the mosque at Mecca is also mentioned as perhaps a case in which a meteorite has been selected for long continued worship. The author then goes on to discuss a number of instances recorded in classical literature, and, although it is impossible to say that in each case a meteorite was the object described, in many cases it seems highly probable. The Palladium of Troy, the Needle of Cybele, the original image of the Ephesian Artemis, are some of the cases which the author describes in detail with quotations from the original authorities. On a later page of the same number a description is given by Warren M. Foote, of a new meteoric iron from the Sacramento Mountains, in New Mexico. This is a typical siderite and weighed, as found, 237 kilograms (521 pounds). It shows the common octahedral structure with unusual distinctness. Two plates accompany the article, one showing the appearance of the iron itself, one-eighth the natural size, the other the Widmannstätten figures printed directly from an etched slab. As further bearing on the same subject is to be mentioned a catalogue of the meteorites in the Yale University collection, which forms an appendix to the number.

The second article is by John Trowbridge and and T. M. Richards, on the *Spectra of Argon*. The authors have studied these spectra, the first one of which is characterized by red lines, and the other by blue, by means of a high tension accumulator giving an electromotive force of over 10,000 volts. The advantages of such a source of electricity of high potential as contrasted with the ordinary induction coil the authors found to be very great. By means of it they were able to study minutely the conditions under which each of the spectra mentioned was obtained. The argon employed was a sample of exceptional purity obtained from Lord Rayleigh, and the tube containing it was prepared with special reference to the work in hand. The authors found that the red glow in the tube was due to a unidirectional discharge, while the blue glow was due to an oscillatory discharge; the conditions determining the change of the red to the blue glow are described in detail. It appears that an argon tube is extremely sensitive to oscillatory discharges, and it is suggested that it is likely to be of great use, on this account, in the study of wave motions of electricity.

George F. Becker discusses at length the hypotheses which have been advanced to explain the differentiation of rock magmas. The segregation of a homogeneous fluid into distinguishable portions has been regarded as due to molecular flow, as is shown in ordinary diffusion or in osmosis. All the processes of molecular flow are shown to be reducible to the movements which are due to differences of osmotic pressure. The most important case of molecular flow as regards the subject under discussion (studied by Soret) is that due to the heating of the solution at the top; this, however, requires a very improbable decrease of temperature with the depth. Furthermore, when the rate of diffusion in two miscible liquids in contact is discussed quantitatively, assuming a rate of diffusion such as that already determined for copper sulphate, it is shown that this rate is *extremely slow*. Thus, in the case of copper sulphate and water in contact, at the expiration of a million years the

water would be sensibly discolored at a distance of 350 meters, while semi-saturation would have been reached only at a distance of 84 meters. When the relatively high viscosity of lava is taken into account, assumed by the author as more than 50 times greater than that of water, the rate is found to be still slower; and consequently a sensible impregnation of the lava would extend in a million years to only about 49 meters from the surface of contact. Further than this, it has been shown that convection would be to some extent unavoidable, and, so far as it acted, it would tend to destroy this action of diffusion. Segregation by the separation of the magma into immiscible portions is regarded as the least objectionable method, "but this seems to involve a superheated, very fluid magma, while the law of fusion and the distribution of phenocrysts in rocks indicate that magmas prior to eruption are not superheated to any considerable extent and are very viscous." The author concludes that "the homogeneity of vast subterranean masses called for by the hypothesis of differentiation is unproved and improbable. The differences between well-defined rock types are more probably due to original and persistent heterogeneity in the composition of the globe. Hypogeal fusion and eruption tend rather to mingling than to segregation, and transitional rock varieties are not improbably mere fortuitous mixtures of the diverse primitive, relatively small masses of which the lithoid shell of the earth was built up."

H. S. Washington describes a series of igneous rocks from Asia Minor. These include some augite-andesites from Smyrna and a biotite-dacite from Pergamon. The microscopic characters are given in full, and also a number of analyses. M. Carey Lea mentions an experiment obtained from a solution of chloride of gold, containing 1 gram to 10 cc., combined with a 10% solution of sodium hypophosphite. The result is a solution of deep green color, which is shown to be due to the presence of a small quantity of gold in its blue form, in a state of very fine diffusion, which, together with an undecomposed solution, gives the effect of green. A. E. Verrill and Katherine J. Bush discuss at length a revision of the genera of Ledidæ and Nuculidæ of the Atlantic Coast of the United States. The authors state that a somewhat extended study of the series of deep-sea bivalves belonging to these families, dredged off our coast by the U. S. Fish Commission, from 1872 to 1887, has compelled them to revise the known genera and subgenera and to propose several new groups. In view of an unexpected delay in the publication of the report upon these families, which had been completed and fully illustrated, it has seemed desirable to them to publish a brief preliminary account of the classification adopted. The present article is the result. Two plates with twenty-two figures show typical forms with details of the hinge structure. The number closes with the usual abstracts, book notices, an obituary notice of Dr. B. A. Gould, etc.; a note is given to the remarkable meteor of December 4th; also a brief account of a gigantic squid formed on the coast of Florida.

SOCIETIES AND ACADEMIES.

BOSTON SOCIETY OF NATURAL HISTORY, BOSTON, MASS.

A GENERAL meeting was held Wednesday, November 18th, 290 persons being present. An account of the work of the Boston party accompanying the sixth Peary expedition to Greenland was given by Messrs. Barton, Burton and Porter.

Prof. G. H. Barton gave a narrative of the line of travel and of the general points of interest noted during the exploration, describing with some detail the character of the inland ice and the structure and work of the glaciers in the Umanak district.

Prof. A. E. Burton described the topographic barrenness of the Umanak district; the abundance of boulders and the stunted growth of the trees was everywhere apparent. With the aid of maps thrown on the screen he showed the stations where magnetic observations were needed, and described at length the results of the magnetic and pendulum work done on the coast of Labrador, on the north shore of Hudson Straits, and in the Umanak district. Prof. Burton gave a detailed account of his study of the Karajak glacier; the motion of this and of other glaciers was carefully measured. An average of 19 feet in seven days was noted and an interesting observation con-

nected with the flow of a glacier up stream was explained by the action of a strong return eddy. The temperature of the air, water and ice in glacial crevices was also carefully recorded. Never to follow streams and never to return except by the way of coming, were given by Prof. Burton as two axioms for travelers in Greenland.

Mr. R. W. Porter gave an account of his sketches of ice structure and of his water colors of the natives.

Stereopticon views illustrated the remarks of all the speakers. SAMUEL HENSHAW,
Secretary.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 255th regular meeting of the Anthropological Society was held Tuesday evening, December 15, 1896. A paper read by Mr. George R. Stetson under the title 'The Eye, the Ear, and the Common Weal of Whites and Blacks,' was a résumé of the literature of eye and ear examinations, including the one made in the Washington schools last winter by Drs. Belt, ophthalmologist, and Eliot, otologist, of 500 white and 500 black children in the 4th and 5th grades of the average ages of 11 and 12.56 years.

The points emphasized in Mr. Stetson's paper were: the prevailing ignorance of the normal power of these organs and their consequent neglect by the 'intelligent' and 'ignorant' classes alike; the gross carelessness of both these classes, even when the defects are known; the importance of systematic and accurate school examinations in discovering defects impossible to remedy in later life, in correcting erroneous and disastrous opinions as to the intellectual capacity of children who have defective eyes or ears, in detecting eye strain or abnormal innervation of the eye muscles, etc., etc., and in the determination of the future occupations of those seriously affected; the great economic value of these tests in the prevention of pauperism and in reducing the number of expensive public institutions.

Mr. Stetson asserted that not a single one of our State Boards of Health or Education had ordered systematic observations, which have been thoroughly made in Germany and elsewhere for several years, also that while the data obtained serve the admirable purpose of pointing out the general neglect of these organs, and of showing the importance and necessity of greater attention to their defects, they failed to be of any great value for general or comparative purposes, because of the absence of uniformity in the methods employed in testing, of periodical examinations and in the ages of those examined, etc. Perhaps most important and convincing evidence of the humanitarian and economic value of such examinations, the writer thought is found in the ignorance and indifference developed by the Washington inquiry, especially in the lower classes. Among the Blacks, of all eyes classed as 'Extremely defective,' 'Very defective' and 'Defective,' 48% were unknown either to parent, teacher or scholar. Of the 'Extremely defectives,' or those with less than one-tenth normal vision, 22.50% were equally unknown. Of the ears of the Blacks, 57% were similarily unknown, and of those having but one third normal hearing, 55%. Among the whites the record is better.

Of all 'defective' eyes, 34.28% were unknown to all, and of all 'defective' ears, 2% were unknown. The examination also disclosed the fact that, with the knowledge of the existing defects, the instances were very rare in either race or social condition in which the persons were under treatment. Otologists and ophthalmologists were shown to be in accord in the opinion that even a partial defect in hearing or in sight will find expression somehow in the mental development, or, put in a different way, that the diminution in mental development will correspond closely to the degree of the visual or aural defect. They are also in accord in the belief that the eye and the ear can be trained and educated to a much higher power than they now possess, or allowed to become atrophied by neglect or lost by abuse. The details of the Washington examination show very slight racial differences. The visual defects were 3.46% greater in the Blacks, the aural defects being equally divided. The difference in the sight and hearing of the right and left eye and ear was very slight in either race, while the maximum percentage of defective eyes of both races was found in the white female. In the Whites the female eye and ear are both the

most defective; in the Blacks the female has the most defective eye and the male the most defective ear. The result of Mr. Stetson's memory test of the same number is reserved for another paper.

A paper by Surgeon-General Geo. M. Sternberg was read, entitled 'Science and Pseudoscience in Medicine,' in which he noted the difference between the truly scientific investigations, with special reference to preventive medicine, in contagious and infectious diseases, and the great service such investigations had been in stamping out epidemics such as cholera, yellow fever, etc., and the so-called science of pretenders and frauds for the sake of gain. He then dwelt at some length on the arrant quackery, charlatanism and fraud practiced by the promoters of numerous well advertised cure-alls which, by plausibly used scientific terms and facts, were calculated by their pretended science to mislead and deceive. This gave rise to an interesting discussion upon the desirability of government supervision and interference in the publication in the press and the sale of such preparations. Messrs. McCormick, Ward, Stetson, Pierce, Farquhar, Blodgett and others took part in the discussion.

J. H. McCormick,
Secretary.

TORREY BOTANICAL CLUB.

At the meeting of Tuesday evening, December 8th., thirty persons were present and one new active, and seven corresponding members were elected. The death of Mr. Wm. H. Rudkin, one of the oldest members of the club, was announced by Dr. Britton and a committee was appointed to take suitable action. It was resolved that a complete list of the corresponding members should be printed in the December number of the *Bulletin*. A contribution by Dr. T. F. Allen, entitled 'Descriptions of New Species of *Nitella* from North America and Japan' was read by title by Dr. Britton, in the absence of the author. Mrs. Elizabeth G. Britton presented a 'Contribution to the Bryology of Bolivia.' It reviewed the more important collections of Bolivian mosses, the treatment which they had received and the present work in progress on this subject, and enumerated the bryological collections made by Dr. Rusby in Bolivia in the years 1885 and 1886. This collection contained 96 species, in 39 genera, 42 of the species being hitherto undescribed. Dr. H. H. Rusby spoke of 'Botany at the Pan-American Medical Congress held in the City of Mexico, November, 1896.' This paper contained brief references to the character of the flora observed on the journey to Mexico, an account of the scientific progress in the city, especially pertaining to applied botany and referred to the botanical work organized by the Pan-American Medical Congress. It was supplemented by remarks upon the same subject by Mrs. Britton, who also attended the Congress. A number of important publications by the *Instituto Medico Nacional* were exhibited. Dr. N. L. Britton described a new species of Geranium hitherto confounded with *G. Carolinianum*. The papers by Dr. Allen and Dr. and Mrs. Britton will be published in the *Bulletin*, that by Dr. Rusby in the *Druggists' Circular*. On motion the Club adjourned to meet on the second Tuesday in January.

H. H. Rusby,
Recording Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of St. Louis on the evening of December 21, 1896, Mr. H. von Schrenk made some remarks on the parasitism of lichens, illustrated especially by the long hanging forms of *Usnea barbata*, common on *Juniperus*, etc., on Long Island, N. Y. It was shown that these lichens do not penetrate below the outer periderm of the host, and consequently are not to be regarded as true parasites, but that they frequently cause the death of the latter by suffocation. As Schimper has noted for the long moss of the South, *Tillandsia usneoides*, the plant is capable of dissemination by wind and birds, and of growing in new stations without attachment.

Officers for 1897 were nominated.

Wm. Trelease,
Recording Secretary.

Erratum: Prof. H. A. Hazen calls our attention to the fact in our letter from M. W. de Fonvielle on page 762, Hersuite should be Hermite and 60,000 m. should be 15,000 m.